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When we in 1989 decided to design Australia's finest range of loudspeakers, we soon realised the potential we had on our hands.

By designing and building the speakers in Australia, and by using the ultimate drivers available, we could challenge the best loudspeakers from around the world. With this in mind we now set out to achieve our goal.

The choice of drivers was obvious: DYNAUDIO. They are known the world over as being the finest drivers available. The high cost however, makes their use prohibitive for those speaker manufacturers who only produce mass market speakers. Our intention though, was not to make another mass market range of loudspeakers, but rather Australia's finest.

The next step was to appoint a design team. The ideal team should have not only the best technical qualifications and facilities, but also a great love and appreciation for music.

With the design team chosen, work began in February 1990. Now followed an exhaustive but rewarding 14 months of intensive research and development. Numerous prototypes were built and refined until each model fulfilled its objectives: Being the finest in its class.

The listening panel comprised not only the design team, but also Hi-Fi critics and leading audio dealers from around the country. Each prototype was compared against the more expensive imported equivalents until the design team was fully satisfied.

In June 1991 Australia's finest range of loudspeakers was released : DYNAUDIO IMAGE.

WE HAVE DONE ALL WE CAN ..... NOW IT'S UP TO YOU !

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Acoustical Design: Glen Leembrugen & David Connor, Sydney Australia
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Monster Cable: Noel Lee, San Fransisco USA
Cabinet Builder: Scott Krix, Hackham South Australia
Listening Panel: Glen Leembruggen, David Connor, Pat Hayes, Les Cardilini, Philippe Luder, Dahl Murphy, Carlo Di Martino, Craig McNeil, Michael Henriksen, David Jacobs, Tom Manning

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December 1991

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

New camcorders: smaller *and* more flexible

As well as becoming more adept at shrinking their products to ever-smaller sizes, camcorder makers are also managing to crank up their performance (and price!). Barrie Smith looks at some of the features offered by the latest models, in our feature story beginning on page 18.

Controlling radio gear with your PC

In the second of his articles on using your personal computer to monitor and control radio gear, Tom Moffat describes a low-cost interface for Icom receivers and transceivers. (See page 94)

Bonus Semiconductor Listing from GWE!

Wondering where you can get that special IC or discrete semi? The odds are you'll find it in Geoff Wood Electronics' very latest semiconductor stock listing, in the centre of this issue. GWE specialises in supplying exotic and hard-to-obtain devices...

On the cover

Now available at Dick Smith Electronics stores, the new Ensing Karaoke unit combines a cassette player (with karaoke functions), an AM/FM radio and a mini PA system — making it a flexible 'fun machine'. Our review starts on page 32. (Picture by Kevin Ling)

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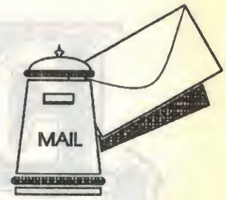
LETTERS TO THE EDITOR



Bulletin board?

I am writing to you to offer a suggestion that you may wish to develop and incorporate into your magazine.

My suggestion is that your magazine set up a bulletin board system where subscribers can via a modem, gather information related to electronics.

The service might have a database of projects or articles which have been published in your magazine, or SPICE models of projects, hints or notes and errata for projects, programs relating to electronics, and the ability to lodge letters to the editor and information columns or submit circuits to your circuit and design section.

The number and range of things that could be provided by such a service is almost limitless. I also believe that such a service would be very well received by your readers, as I am sure that a large proportion of them have both a computer and a modem.

David Adkins,
Kensington, NSW.

Comment: We'll see what can be done, David, but we have limited resources. Bulletin boards are also vulnerable to abuse by virus propagators and other antisocial types.

Circuit needed

I would like to request service information or at least a circuit for a Healing monochrome 12" portable TV model P3051. I would be quite happy to pay someone a reasonable amount for such, if they have it.

B. Holcombe,
'Aviemore',
Burren Junction, NSW 2386.

Scanner enthusiast

I've been reading your magazine since last year and totally enjoy every minute of it. I would like to thank Arthur Cushen of your 'Shortwave Listening' for his help with time codes and your 'Basic Electronics' is an excellent idea.

I am interested in radio communications such as Amateur radio, CB's, shortwave and scanners.

I am just starting a club for Scanners in the Brisbane area called the 'Scanning Group', otherwise known as 'SG', so anyone out there please contact me at the address.

I would also like to point out that many people that wish to do TV and radio servicing can't because of full time work, but there is a solution. Correspondence TAFE which is mostly part time, or the Government TAFE which is fairly cheap compared to other groups.

Matthew Gee,
5/31 Kidston Terrace,
Brisbane, Qld. 4032.

Future suggestions

I would like to suggest a four to eight speaker Home Theatre Sound Decoder, preferably with a Dolby Pro HX and as comparable units retail between $1000 and $3000, it would have to be a popular project. Perhaps some dialogue on how to set it up, what ratio of watts should be used between the various dedicated amplifiers? What type of speakers should be used as surrounds? How should they be positioned? Does it need a centre channel speaker?

I hope these ideas prove worthwhile. I, for one, would purchase a kit of this type.

Congratulations on a very successful Electronics Magazine.

Peter Morris
Blackhurst, NSW

Comment: Keep reading Peter, a project as you've described is scheduled for publication very soon now.

Audio problems

I am a new subscriber as of this month to your excellent publication and congratulate you on the wide range of interesting articles. The August Forum article placed considerable emphasis on the improvement prospects of video technology — I am asking if some future emphasis could be placed on improving the quality of TV audio.

My wife and I are in our 70's and have great difficulty in understanding the actor persons who 'flood' our screens in TV plays, etc. I have tried infra-red transponders, outboard speakers, even headphones, all to no avail, although British actors are much easier on the ears.

I would like to know if other 'oldies' have a similar problem?

The infuriating part is that TV commer-

cials come in loud and clear and as these comprise about one third of the programme, it rubs even more salt into the wound. Oviously, it is not our hearing that is at fault. Maybe one of your TV buffs could come to the rescue with a solution?

Kindest regards and may your subscribers multiply.

Comment: Great to have you as a subscriber, John. Thanks for your suggestion, we'll see what can be done.

PSPICE shell

Regarding your recent articles on SPICE. At Holden's we have developed a 'shell' for PSPICE using Orcad as the graphics front end.

The control shell is primarily designed for finding 'sneak paths' in a vehicle circuit (sneak paths are caused when power from one system finds its way into another via shared sensors, etc). It takes into account the resistance of connecting wires and provides a means for changing the state of switches and fuses and queuing jobs for overnight PSPICE processing. We are considering marketing this package should there be sufficient interest.

Mike Hammer,
GMH-Automotive,
Mordialloc, VIC.

Re-inking ribbons

I had one of our electronics customers who stock and have been selling WS-40 for some time, call me in relation to your article in the September issue (p.93), on re-inking ribbons.

I am not sure if the product CRC 2-26 or CRC 5-56 actually does what is claimed; but if it does, well and good. I am however concerned about the claim made that WD-40 would gum up. WD-40 has been used and proven for this use for many years, and in fact, we believe this use was actually discovered by a WD-40 user.

I would appreciate your clearing up this matter with the appropriate comment in your next issue.

Garry Ridge,
Managing Director,
WD-40 Company,
Epping, NSW.

DROP US A LINE!

Feel free to send us a letter to the Editor. If it's clearly expressed and on a topic of interest, chances are we'll publish it — but we reserve the right to edit those that are over long or potentially libellous.

EDITORIAL VIEWPOINT

Reflections on the recent pay TV decision

At last the Federal Government has made a decision to allow pay TV to operate in Australia from next October, and to my mind that's basically good news — not just for Australian viewers, who will soon have a wider range of viewing options, but also for the Australian electronics industry. Even though a fair bit of the equipment required for both origination of programmes and reception by subscribers will no doubt be imported, at least initially, in the longer term there's bound to be a significant spinoff for local industry as well.

Considering that one fairly obvious motive in giving the go-ahead was to boost the appeal of Aussat to consortia bidding for the right to be our second national telecommunications carrier, it was also good to see that the decision will allow cable distribution (MDS or 'single channel multi-point distribution') of pay TV as well. Distribution by optical fibre cable makes a lot more sense than satellite broadcasting for urban areas (where most of Australia's population resides), and is obviously going to be the most cost-effective urban distribution medium in the long run — not just for distribution of pay TV, but for many other communications services as well. It would have been very short-sighted to insist that everything had to be distributed by satellite.

In any case, allowing cable distribution should encourage genuine diversity in pay TV programming, by allowing niche operators to reach special-interest subscribers at relatively low cost. Who knows, we might also end up with slightly fewer dish and 'squarial' antennas festooned all over our buildings, too — but perhaps that's a forlorn hope...

So it seems to me that there's a fair bit of good news in the Government's decision. But there is *one* aspect that I personally find rather puzzling. Perhaps I'm just a bit dense, but what was the logic behind the decision to give four of the six available national satellite channels to a single large 'exclusive operator', and only have the other two channels available later, for separate smaller operators?

To my mind, if the Government was genuinely trying to encourage diversity of control and programming, it would have made more sense to have all of the channels available straight away — but to separate operators, with no single operator able to own or control more than one. Then there wouldn't have been nearly as much need to come up with complex ownership and control rules, to ensure that the main licence isn't effectively snapped up by either an existing local media mogul, or a large overseas operator.

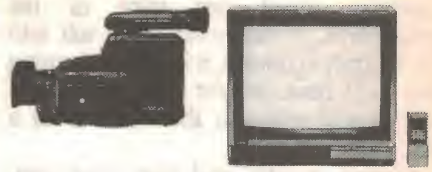
Perhaps I'm wrong, but it sounds a bit as if the whole idea of offering four channels together as a parcel — complete with 5-year monopoly — was specifically so that the opportunity *would* appeal to big media moguls and/or overseas investors...

But be that as it may, we now seem set to get pay TV around this time next year. And given half a chance, that should be good for both viewers and our currently rather fragile electronics industry.

In the meantime, and on behalf of everyone here at *EA*, I'd like to wish all of our readers and advertisers a very happy Christmas, and a New Year of hopefully greater prosperity than 1991 has been!

Jim Rowe

What's New in VIDEO and AUDIO



120" TV projector from Sanyo

The Sanyo 'Premier Collection' PLC-100PP LCD Colour Video Projector has been designed to appeal to people who wish to have theatre-style video entertainment in their own homes.

With performance described as 'spectacular' big screen quality, the unit will operate with any of the world's four major television systems, projecting very clear images up to 2800cm (120") diagonal.

The unit's high definition and brilliant colour reproduction is made possible with the use of a 331, 350 pixel liquid crystal panel.

A remote controlled motor-driven zoom function enables approximately 2.0 times zooming for close-up images, and the picture can be adjusted from any dimension from 53cm to 2800cm.

The full-function, hand-held remote control unit can also select power on/off, focus, volume, volume mute, colour, brightness, tint, contrast, sharpness and more.

Rear projection is possible with the unit's left/right picture reverse. A built in speaker and amp allow stand-alone operation. Terminals are provided for an audio monitor output, S-video input, composite video in and one SCART (21-PIN) connector.

The unit's recommended retail price is $7500.

'S-video' slide/neg scanner

Sony has released the PHV-A7, a camera that is able to convert ordinary photographs into video signals.

With this converter camera it is possible to put together a high-quality 'video album' made up of photographs, or to create videos that combine still photos with previously recorded video tracks. The PHV-A7 is able to work with both negative and positive film and smoothly convert them into video signals. And with its easy to use editing functions, the PHV-A7 offers the user great creative flexibility.

A special feature is the zoom function, which can magnify up to 6x. As well as allowing close-up shots and detail enlargement, this function facilitates precise trimming of the image. The enlarging function also means that film less than 35mm in size can be used and will fill the entire video screen.

Light in weight and easy to operate, the PHV-A7 features an external microphone jack for recording a narrative track. It is also able to function as a means of inputting visual data into computers equipped with video-input terminals.

The colour balance control makes it possible for the colour of converted images to be precisely adjusted. In this way, unevenness of colour can be eliminated, to compensate for the age of the film or differences in film processing.

Crisp picture quality is ensured by the built-in precision CCD chip (470,000 pixels) and S-video output jack, with a horizontal resolution of over 400 lines.

Bose unveils new Acoustimass 3 system

Bose has released the new Acoustimass 3 Series II, featuring design improvements that take the sound performance of the world's smallest three piece speaker system to new heights.

The system's visible components are two tiny speaker enclosures that can be positioned virtually anywhere in a given room. Measuring just 9 x 11.5 x 11.5cm and weighing only 1/2 a kilogram each, these speakers deliver clean, crisp high and mid-range frequencies.

Each speaker contains a single long-throw 6.5cm wide-range transducer, newly designed by Bose for this system. Each driver is fully magnetically shielded, allowing it to be positioned near video monitor/receivers without interfering with picture performance.

The heart of the Acoustimass 3 Series II is the Acoustimass bass module. Providing rich, deep low frequency energy for the system, the unit can be hidden anywhere in a listening environment — even under furniture or behind drapes.

The Bose Accoustimass module launches sound waves into a room in the form of two moving air masses — unlike conventional systems that rely solely on the vibration of a speaker cone.

The result is pure sound, greater dynamic range, no undesireable port

noise and low distortion. The Acoustimass 3 Series II bass module measures just 20 x 20 x 35cm and weighs only 6.35kg.

The Acoustimass 3 Series II is compatible with amplifiers or receivers rated from 10 to 100 watts per channel. The system is available in arctic white and black, at a suggested retail price of $879.

Philips producing HDTV tubes in Germany

As a European standard for HDTV moves closer to reality, Philips has introduced a range of 16:9 colour picture tubes. Production of 36" tubes has already begun, and the company's plant in Aachen, Germany was to begin making 28" tubes in October.

The rapid scaling up of 28" tube manufacture to mass production levels means that Philips tubes will be among the first available in this size. Known as Cineline, the new range will be completed by a 32" tube to be introduced next year.

The introduction of the Cineline range means that Philips will be well placed to meet the growing demand for colour picture tubes in HDTV format.

All Cineline tubes feature Philip' new DAF (Dynamic Astigmatism and Focusing) gun, which ensures perfect beam focusing right across the picture. Designed for operation at 32kHz line frequence, for a flicker-free picture, the tubes achieve high contrast and brightness by employing the Invar screen technology used in Philips' Black line range.

More 'intelligent' VCRs from Akai

Akai has expanded its range of 'Intelligent HQ VCRs first released late last year. The Intelligent HQ system is a novel one whereby every videotape can be optimised in both recording and playback modes by 'auto tuning' the equalisation characteristics. Akai claims that its IHQ system gives outstanding picture quality previously unseen on VHS VCRs, and that when used with premium quality tape such as S-VHS video tape, picture quality is of such high resolution and detail it is comparable with the S-VHS system. The IHQ circuitry is completely compatible with standard VHS format tapes and is particularly useful in improving heavily played rental tapes.

The new VS-F510 (RRP $899) is an intelligent HQ hifi stereo VCR with a double azimuth crystal ferrite DX4 head, which offers two speed operation and a jog shuttle for precise picture searching. It produces hifi stereo sound and offers stunning realism comparable to digital audio equipment. Dynamic range is over 90dB and frequency response flat from 20Hz to 20kHz, with less than 0.005% wow and flutter. The VS-F510 further boasts 45 channel synthesised stereo tuner, dual-mode digital tracking, and programmable remote controller with LCD.

The new IHQ VCR line up is covered by a twelve month parts and labour warranty and most models are available at selected department stores and Akai dealers.

Compact CD-based table-top system

A new table-top stereo system, YST-99CD, has been introduced by Yamaha. This incorporates a CD player in its main module, which also contains an AM/FM stereo receiver with 19 presets and a multi-function LCD display with clock/timer.

The new model features new slimline styling and has a slate-grey finish. Its Active Servo Technology amplifier/speaker circuitry enables the YST-99CD to provide dramatic and accurate bass response from small speakers.

The entire system can be operated from the main module or by a credit card size remote control keypad. Suitable for a bedside table or other small surface, the main module measures 355 (W) x 62.5(H) x 191.5mm (D).

The CD player is a top-loading unit utilising a 4-times oversampling filter and twin digital-to-analog converters. It provides 24-track random access programming, repeat play and resume play. In addition to the convenience of 19-station AM/FM preset programmability, the receiver uses a quartz synthesised tuning system and its low distortion Active Servo Technology amplifier delivers a signal-to-noise ratio of 95dB.

The speakers which come with the system have been designed for it. Using Yamaha's Active Servo Technology circuitry, the small slimline speakers are 72mm deep, 200mm wide and 270mm high. They deliver a remarkably wide frequency range of 45 to 20,000Hz and can be unobtrusively hung on a wall or placed on a shelf. Yamaha's new YST-99CD table-top stereo system has a suggested retail price of $699. An optional 12 volt DC adaptor is also available. ■

Product review:

Philips' 60cm (25") 'Matchline' TV receiver

We recently had a chance to check out one of Philips' latest offerings in the 'high end' of the TV receiver market — the 25FL 1760. This features a large screen format, full stereo and surround sound, multi-standard reception, PIP (picture in picture), Teletext, and a wide variety of input/output connections.

As it happens, this is not the first time we've had a look at one of Philips' 'Matchline' sets. In the May 1990 issue of *Electronics Australia* we published a review of the then-new 70cm Matchline receiver (model 28DC 2070), which was quite impressive in terms of its picture, sound and range of features. So it's with some interest that we now take a look at the latest model in the Matchline series, to note how it has changed over the past year or so, and generally see what it has to offer in the home entertainment arena.

The review model in this case has a 60cm screen, and is the smallest unit in the new range of Matchline receivers — Philips also produces a 70cm (29") and 80cm (33") model, although the largest version is not yet available in Australia. Our impressions of the test unit should apply to all models however, since all three sets appear to use the same electronics (or 'chassis') and therefore should offer identical features and performance. We can safely guess that this is the case, since the operating manual's instructions and diagrams apply to all models, and the supplied schematic diagram shows only a few minor differences between the three.

While the 25FL 1760 is the smallest in the Matchline range it's still a physically substantial set, and easily qualifies for the 'large format' class of TV receivers — it weighs in at around 36kg, and measures 590 x 540 x 440mm. As you can see from the associated shots however, the Philips sets don't *look* particularly large, thanks to the clean and uncluttered cabinet lines, and lack of visible controls or switches.

The only controls that are available on the set itself are hidden beneath a small flip-down panel, positioned on the front of the case, just below the screen. This 'control' area is also shared by an indicator panel, which illuminates various symbols to show the receiver's status (standby/on, stereo, bilingual, etc), and a simple push-button power switch. As you've no doubt already guessed, the Matchline is intended to be operated by an associated infra-red remote control, which of course is supplied with the set. Nowadays, the remote control is not so much an additional feature, but an integral part of the set's operations — lose it, and you're in trouble!

Remote control

Considering the enormous range of features offered by the Matchline sets, it's not surprising to find that the remote control itself is quite an elaborate unit — at 140 x 130 x 30mm, it's also rather large. However, Philips have taken the sensible approach of grouping all of the commonly used buttons (volume, channel select, etc) in the centre of the unit, and hiding the more specialised control buttons under flip-up panels on each side.

With the remote's two side panels closed only 17 large buttons appear, which are both clearly labelled and arranged in a logical manner. The end result is that for general TV operation, the remote is extremely straightforward and intuitive to operate. Note that most other sets with a similar number of features tend to offer a remote control with say 50 small buttons all grouped in the same area, each of which has an equally small (and often confusing) matching symbol to indicate its function.

Another nice aspect of the Philips remote control is a small liquid crystal display (LCD) which is recessed into the front panel near the top of the unit. This is used to show which of the eight possible devices the remote is currently controlling, as selected by the control's Mode pushbutton — this can be the TV itself, or a variety of other Philips products such as VCRs, Laserdisc players, hifi systems, and so on. The display itself is activated each time any of the remote's buttons are pressed, and blanks out (presumably to preserve battery power) after about 15 seconds.

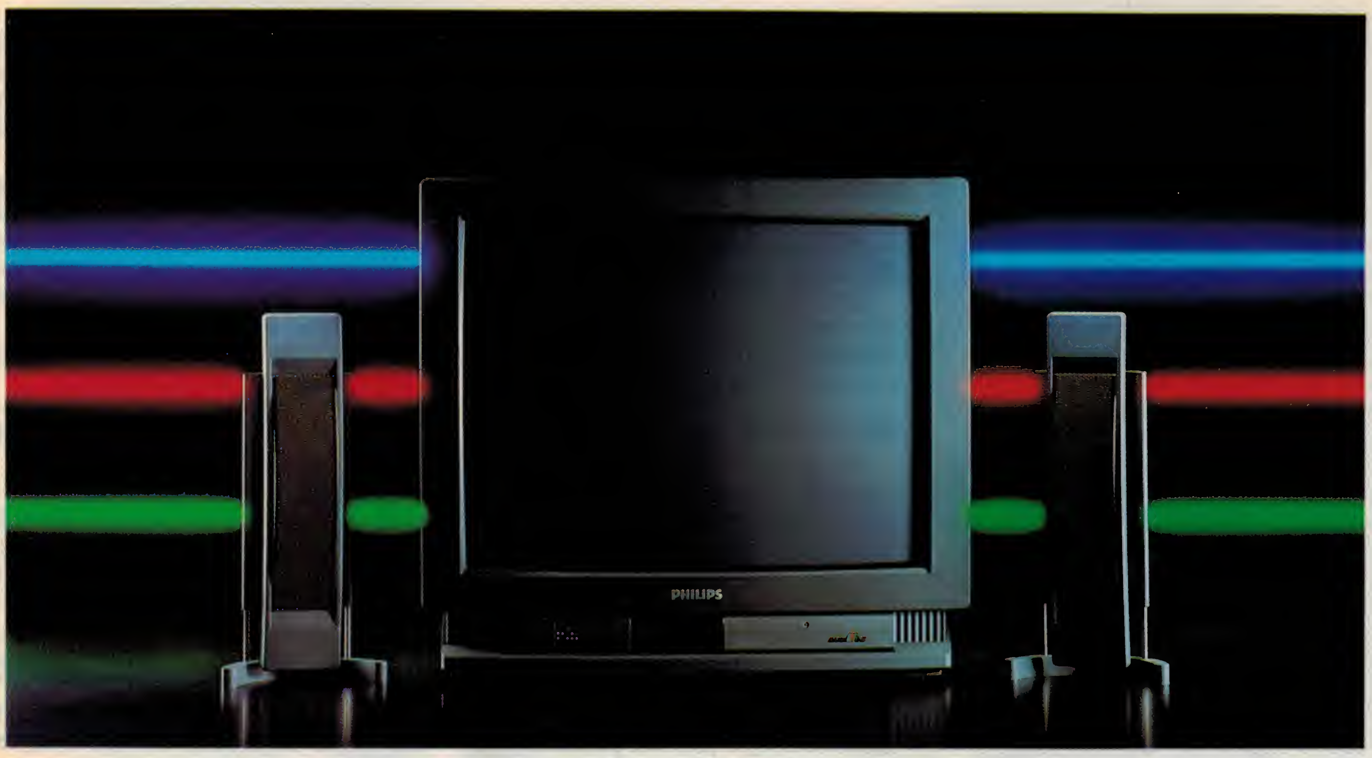
When the remote's two flaps are opened, its capabilities are considerably expanded — as well as looking rather like a fruit bat in full flight! Controls are then available for Teletext operations, the PIP screen, VCR transport, basic picture and sound options, and a series of menu control buttons. The menu system allows the user to adjust and preset most of the Matchline's options, through a series of pop-up 'windows' which occupy a small section of the TV's screen.

Philips have also included sets of stick-on labels (one for each supported language) which attach to the inside of the two cover flaps, so that each of these normally-hidden buttons has an associated brief descriptive label, as well as its matching symbol — a nice touch.

So all in all, we'd have to give full points to Philips for the layout and operation of the Matchline's remote control. It may be large, but it's friendly...

Pictures

We've come to expect first class picture quality from any 'high-end' TV receiver these days, and the Matchline is no exception. We found the pictures to be both sharp and stable, with well defined colour areas. Philips have also included their NR (noise reduction) and CTI



(colour transient improvement) features, which are intended to further improve the general picture quality of these large-screen sets. We found the NR option in particular offered an improvement under weak signal conditions, where it reduced the level of the picture's 'snow' content by a considerable degree.

While the PIP (picture in picture) display is of limited benefit when the set is used to simply watch an off-air signal, it can be quite handy when Teletext or other signal sources are being used. When scanning through Teletext pages for example, you can pop-up an off-air signal in the PIP screen so as to monitor when your favourite program is about to start — or perhaps, when your least favourite program is about to finish!

Also, since the Matchline can connect to a variety of independent video sources (VCRs, Laserdisc players, etc), the PIP screen can be used in a similar manner. Again, you could be watching a video from the VCR whilst occasionally checking the transmissions from any TV station, or visa versa. The PIP image can also be 'frozen' at any time (since it is a digital reproduction of the chosen video source), moved to any quadrant of the main screen, and made to swap video sources with the main display — all under the command of the remote control.

While the remote only has dedicated up/down buttons for the picture brightness, the other main image adjustments are available through the Matchline's pop-up menu system. You simply select the on-screen 'picture' menu with the remote control, choose an adjustment (colour, contrast, etc) and vary its level with the remote's +/- buttons.

Sound

A TV receiver's sound quality is probably one of the most variable aspects when choosing between similarly equipped models from different manufacturers — in fact, it's often the deciding factor at the time of purchase. In this respect, the Matchline delivers more than acceptable performance, with a nicely balanced sound that's free from cabinet resonances and significant peaks or dips in the frequency response curve.

To achieve this result however, the set uses a rather unusual arrangement of speaker and amplifier combinations for its stereo and surround sound functions. The first and most obvious sign of the Matchline's unconventional audio system is the two narrow plastic moulded speaker enclosures, which either clip to the side of the receiver's case or mount on their own U-shaped stands.

These 'squeeters', as dubbed by Philips (squawker/tweeter — get it?), contain a small (60mm) loudspeaker and are intended to handle the mid and high frequency signals for the left and right channels. The low frequency information on the other hand, is reproduced by a *single* 120mm driver which is installed in a moulded opening in the upper rear section of the Matchline's heavy-duty plastic case. Presumably, the idea is that since little stereo information is generally available at bass frequencies, only one woofer is necessary for a clear overall sound — and in practice, this seems to work quite well.

According to the set's schematic diagram, the crossover for this two-way speaker system is formed by just two 22uF capacitors — one in series with each squeeter. This theoretically produces a first order (6dB/octave) high-pass filter, which rolls off bass frequencies below about 1kHz. Conversely, there is no reduction in the high frequency signals passed to the single bass driver, which seems have a natural treble roll-off to complement the squeeters' filtered response.

To power the Matchline's speakers, the chassis contains no less than *six individual power amplifiers, all based around Philips' TDA1521 dual power amp chips (three in total). A few quick tests in our lab showed that each amp was capable of delivering about 5W RMS into an 8-ohm load, and around 8W RMS into four ohms. As it turns out, these amps are connected to the various speakers in a rather clever manner.*

In normal operation, the set only needs to power three speakers; two squeeters and the single woofer. In this case, an amplifier is assigned to each of the squeeters, and *two amps are connected in bridged mode to drive the woofer — this gives a power capability of 5W RMS for each of the high/mid channels, and (on*

test) around 15W RMS to drive the single woofer.

However, the Matchline's internal speakers can be switched out, and a conventional set of enclosures wired to the external speaker connections.

In this arrangement, the speaker switch reassigns the same four amplifiers in two bridged pairs, with one pair for each of the left and right channels — this gives a healthy power capability of around 15W per channel for external speakers.

In both of the above cases, the remaining two amplifiers are also connected in a bridged configuration, and are driven by the set's surround-sound processing circuitry. The outputs of this amplifier are in turn connected to two sets of rear speaker terminals, which are wired in a series configuration — rather an odd arrangement.

Nevertheless, the mono surround-sound signal can ultimately drive two rear speakers, with a power capability of around 5W RMS per enclosure (if each speaker has an 8-ohm rating). As it happens, two small speaker enclosures are supplied with the Matchline set for just this purpose.

The surround-sound processor itself will decode rear channel information from a normal stereo program, or from a Dolby encoded source. Unfortunately we didn't have access to any Dolby encoded source material to try out the latter feature. The surround-sound synthesized from a normal stereo program was surprisingly effective however, and added a significant level of aural depth to the sound on most TV programs.

Once again, the adjustment controls for this feature (null balance and relative volume) are accessed via the Matchline's on-screen menu system.

More features

The list of the Matchline's options and capabilities does indeed go on. It offers a fully synthesized scanning tuner, the ability to decode all of the common international transmission standards (PAL, NTSC, SECAM, etc), full Teletext capabilities (with user-defined page memories), bilingual mode, a programmable sleep timer, a 'spatial' sound option (for a pseudo-stereo sound from a mono source), a personal preference feature (recalls a set of user-defined adjustments), and a Parental mode to disable the set's front panel controls...

To make the most of all of these features, the 25FL 1760 also offers a very generous range of input and output connections, and the ability to switch between each source at the touch of a button. The actual connector systems fall into two distinct classes: the 'S-VHS' or luminance/chrominance (Y/C) style with 5-pin mini DIN and RCA sockets, and the 21-pin SCART (or Euro) socket.

While the set's large number of sockets and the manual's connection diagrams all appear rather confusing at first, it basically allows the user to connect three distinct video peripherals and channel the sound to an external playback system.

It's in fact a very versatile connection system, since both sound and picture signals can be switched between various inputs and outputs, all under the command of the remote control.

The Matchline's rear panel has both S-VHS and SCART connectors for the 'VCR' input/output, a SCART socket for the 'AUX' connection, and standard RCA-type sockets for the main audio output. The front panel on the other hand, has S-VHS connectors to receive signals from a video camera (the set's 'FRONT' input), plus an extra RCA socket to suit the video connector of older style cameras.

In practice, a well-heeled user might access a VCR via the 'VCR' connectors (not surprisingly), a Laserdisc player at the 'AUX' socket, and an S-VHS or Hi-8 camcorder through the 'FRONT' connections. Of course the receiver's sound could also be reproduced through a near-

The Matchine's remote control shown with its side 'flaps' open. The most commonly used buttons are gathered in the centre of the unit, while the more specialised function buttons are normally hidden under the flaps. Note the LCD screen at the top of the unit, which shows the remote's current mode.

by hifi system, for even better sound quality.

Old versus new

So have the Matchline receivers significantly improved since we reviewed an earlier version in the May '90 issue of *EA*? In short, we'd have to say that it has — but with a cost.

Where we've mostly gained, with the latest model, is the addition of a few new features. It now decodes stereo signals in the Dolby surround-sound format through a dedicated rear channel amplifier, where the old model simply had the rear speaker terminals wired between the main left and right outputs, so as to pick up any 'difference' signals. Even without Dolby encoded source material, the new Matchline delivers a very realistic surround sound effect.

While the other new features are relatively minor, such as the picture Noise Reduction option and the ability to vary the size of the PIP window, the redesigned remote control should be held up to other manufacturers as an example of sensible ergonomics — the most-used buttons are large, accessible, and well laid out.

The other aspect that we were pleased to see is the number of accessories which are included as standard items with the new model. There's no need to rush out and buy a set of rear surround speakers for example, since a couple of small plastic-molded enclosures are already included in the set's packaging. These appear to have 100mm drivers, and produce a sound that's quite adequate for their intended job — they even have a generous length of speaker wire attached.

Also included is a SCART-to-RCA connector cable, for those who haven't any SCART equipped peripherals. This is terminated in six individual RCA plugs, which allows the video, and left and right audio signal to pass in both directions. A lack of this adaptor cable was in fact our only real criticism of the previous Matchline model, where we noted that most VCRs and similar peripherals sold in Australia were equipped with simple RCA sockets for both video and audio connections. So with the additional cable, and the increased chances of using an S-VHS equipped VCR nowadays, the new Matchline set will easily integrate into most people's home entertainment systems.

But while the new model offers a number of definite improvements over the old version (as detailed above), there is one aspect where we suspect that the latest Matchline may have taken a slight step backward. This is in the important area of sound quality.

While we are obviously relying on memory to compare the sound between the two sets (of course, we no longer have the old model in our lab), we felt that the difference was significant enough to warrant mentioning. However, we should point out that the sound from the new set is not really lacking in any critical way, it's just that the old model delivered *exceptional* audio performance — and it's a shame to lose that valuable asset.

Nevertheless, it's not surprising to find that the two models sound quite different, since the design philosophy behind the whole audio chain appears to have changed. The older Matchline model featured separate vented bookshelf-style speakers with a 100mm bass driver and a 25mm dome tweeter, which were driven by 30W amplifiers.

The new model on the other hand, uses two 'squeeters' in combination with a single bass driver, driven by lower-powered amps. While this arrangement in itself is not necessarily a limitation, we suspect the bass driver's rather rudimentary cabinet (the rear case of the set itself, complete with ventilation slots) may restrict its performance.

Nevertheless, for music orientated TV programs for example, its quite a simple matter to turn off the set's internal speakers, and monitor the sound through a hifi system.

In this case the rear speakers are still active, allowing you to enjoy a full high-quality surround sound.

The last — but hardly least important — comparison between the old and new Matchline models is their purchase price. While it should come as no surprise that the price of the equivalent Matchline model has increased by around $200 over the past year or so, it's a relatively minor hike when you consider the number of extra features that have been included in the new model — not to mention the effects of inflation.

More specifically, the 60cm set under review (model 25FL 1760) is priced at $2099, while its larger 70cm brother (model 29FL 1770) will set you back $2699. By the way, the 70cm version is the equivalent model to the 28DC 2070 set of our past review. At these prices the Matchline sets should be very competitive in the 'up-market' range of TV receivers.

For more information on the Philips Matchline sets, contact Philips Consumer Products at the Australia Centre, Figtree drive, Homebush 2140, or phone (02) 742 8311. (R.E.) ■

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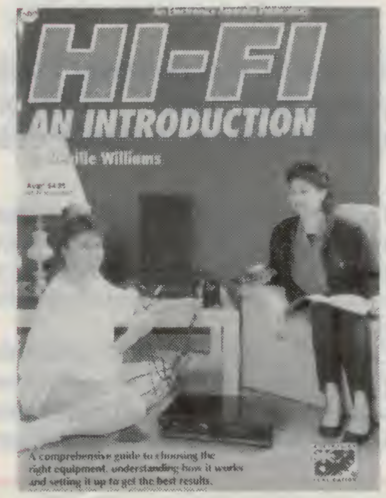

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DYNAUDIO'S COMPACT 'IMAGE 3' SYSTEM

This month our reviewer Louis Challis has been testing the compact two-way Dynaudio 'Image 3' loudspeaker system, which provides high performance at a reasonable price — achieved by using imported drivers in locally designed and manufactured enclosures.

The cost of imported loudspeaker systems has grown steadily for many years, and this has been just as perplexing to the importers as it has been to intending purchasers.

One man who decided to tackle the problem was Michael Henriksen, whose firm Scan Audio in Melbourne currently handles a number of competing brands of speaker systems manufactured in Scandinavia (the majority coming from Denmark).

Michael's approach was simple and straightforward. He would import the drivers from Dynaudio and package them in Australian manufactured loudspeaker enclosures — each of which would be carefully optimised in terms of dimensions, stiffness, crossover features and, last but not least, peripheral hardware such as internalwiring.

Michael retained Glen Leembruggen to design seven different systems — two being two-way, one designed for use on a stand, and four floor-standing systems. All of them with outstanding performance, although with prices which may yet seem daunting for the majority of purchasers.

I auditioned four of these systems at a private showing some months ago, and was impressed by the general performance as much as I was by the underlying philosophy which Michael and Glen Leembruggen had adopted in the development of these systems.

When Michael suggested that I might like to review the Image 3 loudspeaker system for *EA*, I was pleased to respond as the Image 3 falls within the price bracket that you and I would regard as attainable.

The external impression of the Image 3 loudspeaker is at first restricted to the view of a neatly profiled removable front panel with black transparent cloth, at the base of which is a rather bold nameplate with the words 'Dynaudio Image'.

It is only after you remove the neatly designed cover that you become aware of the two outstanding drivers and the reflex venting port below.

The base driver is the new 17W-75 XL, which has an effective diameter of 125mm backed by an unusually large 75mm diameter aluminium voice coil. It uses the hexacoil voice coil construction and rear-venting to achieve excellent power handling capacity within a relatively shallow basket structure.

This low frequency driver is capable

of providing excellent low frequency performance and relatively smooth mid-frequency performance, which is good all the way up to the crossover frequency.

The latter is capable of being set anywhere within the range of 1kHz to 5kHz, although on this occasion the designers have deliberately selected a relatively low crossover frequency.

The 17W-75 XL has other attributes, including a rear-vented centre pole magnetic system, which minimises stray magnetic fields, and also exhibits excellent impulse response.

It is capable of generating reasonably healthy output power levels before distortion becomes obtrusive, and that distortion is very much a function of output frequency.

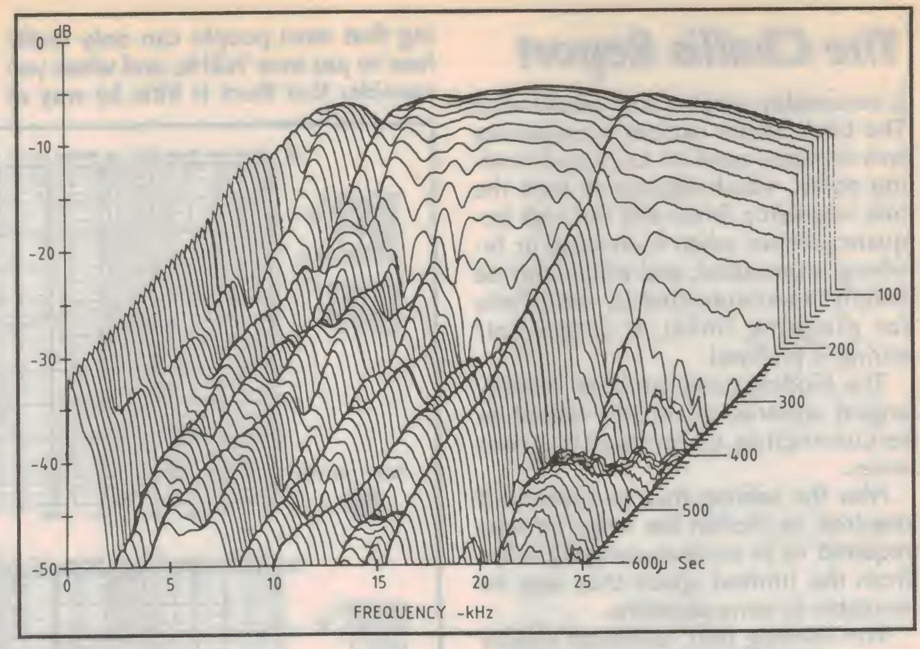
In a correctly sized reflex vented enclosure the threshold frequency can be set fairly low, and with this particular enclosure the response is reasonably smooth all the way down to 50Hz.

The matching tweeter (or high frequency driver) in the Image 3 is the Dynaudio Model D-28 AF. This is a relatively new 28mm soft dome tweeter, which features a low mass diaphragm, and whose soft roll-off suspension is supplemented by a hexacoil voice coil construction similar to that incorporated in the woofer.

There are proven advantages in the hexacoil voice coil construction, as it optimises the current carrying capacity of the voice coil.

It also improves the stiffness and overall thermal capacity, in the minimum possible space so as to optimise the overall magnetic efficiency of the driver.

The addition of Magnaflex liquid cooling (which is a magnetic fluid whose characteristics I still admire, even though the development is no longer new) in the air gap provides a



The decay response spectrum plot for the Dynaudio Image 3 system. The main resonance visible is at 60Hz, with another fairly sharp one at 16kHz.

further order of improvement in the tweeter's power handling capacity.

The Magnaflex liquid simultaneously provides an improvement in the damping characteristics of the driver to minimise unwanted spurious resonances, which frequently plague many high performance tweeters at one or more resonant points in their operating frequency range — and this tweeter exhibits one prominent resonance at 16kHz.

The combination of these features provides a smooth and effective performance all the way out to 20kHz on axis, and enable it to achieve a reasonably good performance even at 30° off axis.

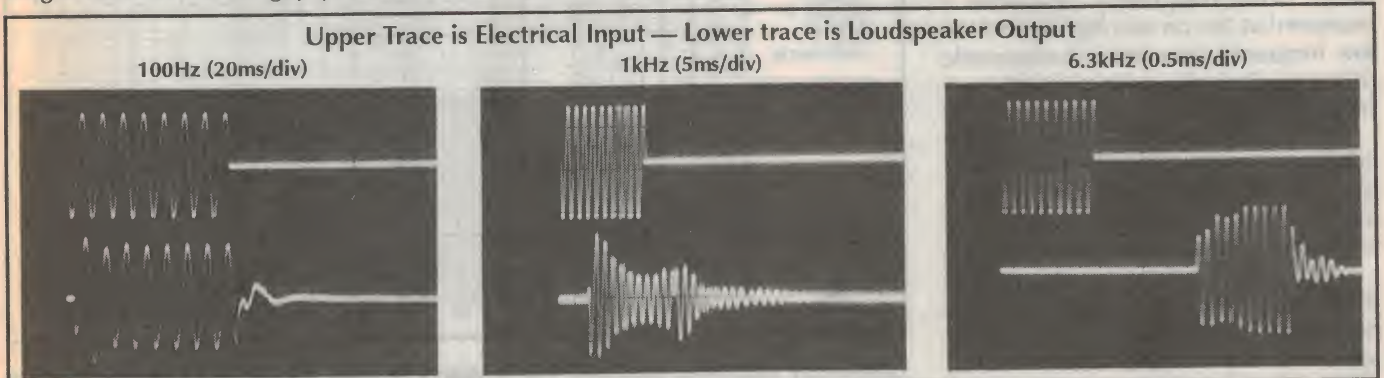
The high frequency performance drops off quite rapidly beyond 10kHz at 60° off axis, but that of course is a problem that faces virtually any other tweeter against which you may wish to compare it.

In the Image 3 system the two drivers are integrated into a solidly fabricated real timber veneered cabinet without any supplementary bracing elements, and with only a modest level of urethane foam damping at the back and bottom of the cabinet.

The crossover circuit uses high quality imported capacitors, ceramic encased and metal film resistors, and large hand-wound air cored inductors, which do not suffer from saturation problems when working at high power levels.

Although the manufacturer's literature states that all the internal wiring is carried out with Monster Cable to reduce the internal power losses to the minimum, my inspection failed to identify the presence of the acclaimed Monster Cable.

Although the cabinet does not incorporate supplementary bracing elements, the level of internal resonances



Tone burst response plots for the Image 3 system for 90dB steady state SPL measured at 2 metres on axis.

The Challis Report

is reasonably modest, and identifiable. The back of the cabinet incorporates two separate pairs of Universal binding posts, which separately feed the low frequency driver and the high frequency driver when bi-amping or bi-wiring is proposed, and which may be simply interconnected by wire links (or plugging links), if single pair wiring is prefered.

The binding posts are most sensibly angled upwards, to ease the task of interconnecting or terminating your wires.

Also the cabinet may be reversed if required, to shorten the length of wire required or to remove unsightly loops from the limited space that may be available in some situations.

The venting port, although simple and straightforward, has relatively sharp edges at both ends, and consequently has the tendency to generate audible distortion as a result of poor airflow entry at low frequencies.

Objective tests

The objective evaluation of Image 3 performance confirmed that the on-axis frequency response of the system is remarkably smooth and almost within +3dB from 50Hz to 20kHz, apart from the measurable notch at 1kHz.

A frequency response performance as smooth as that recorded is already fairly commendable, particularly when so many manufacturers lay claim to this order of performance without actually delivering the goods.

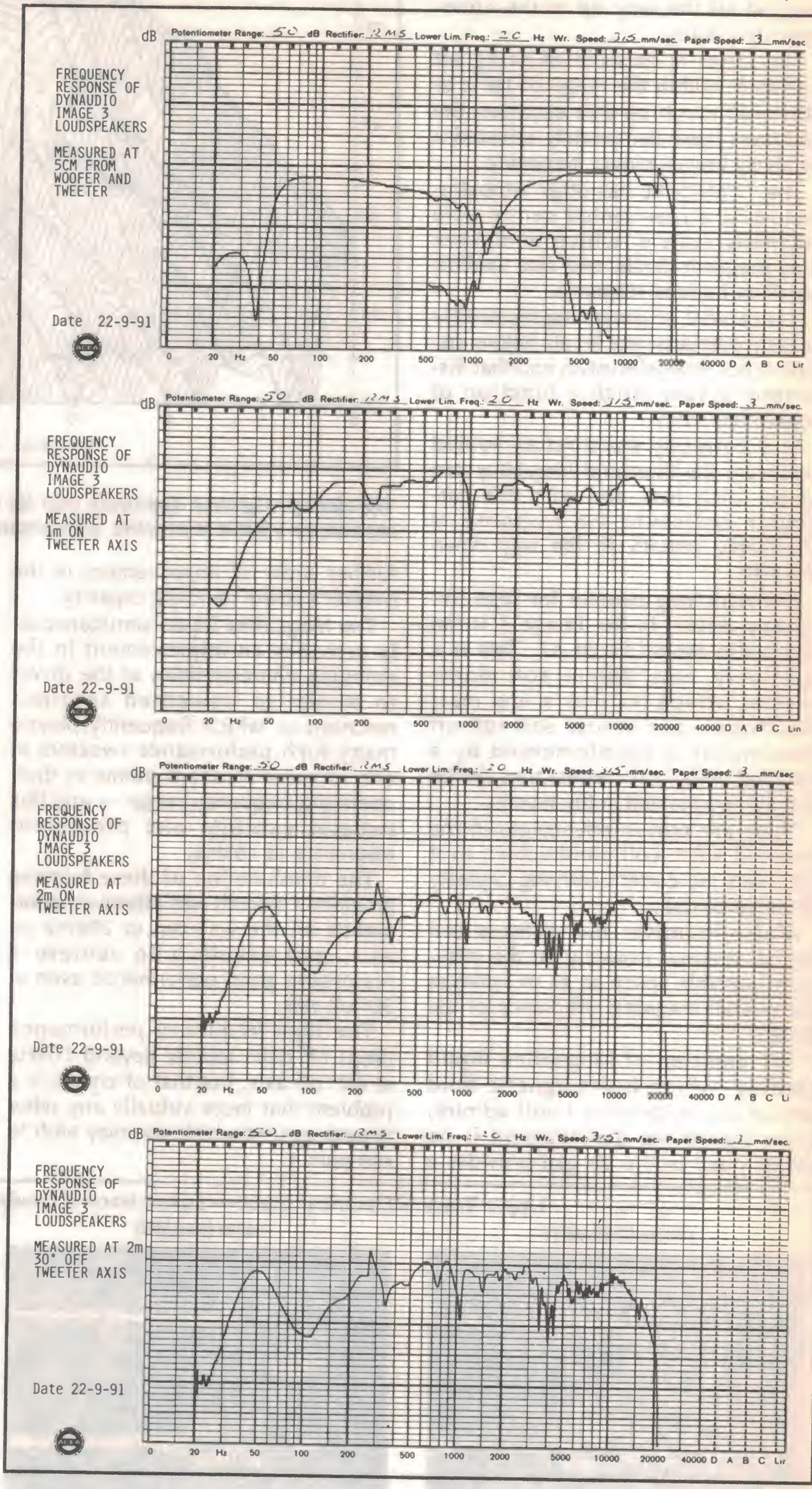
As I discovered by chance as I moved the test microphone from its normal 'on axis' position, this performance varies slightly at various points above and below the median line between the two drivers, and particularly as a result of interference generated by out-of-phase relationships of one driver viz-a-viz the other. The frequency response I measured at 2m on-axis highlighted the low frequency resonance characteristic of the speaker, about which I will have more to say later.

The off-axis testing of the tweeter confirmed that its response is nonetheless still extremely good, and offers a degree of linearity that would generally satisfy the most demanding audiophile.

The frequency response measured at 30° to the main axis drops off quite noticeably above 10kHz and drops by approximately a further 4dB at 16kHz, and by 10dB at 20kHz.

This is still reasonably good considering that most people can only really hear to just over 16kHz, and when you consider that there is little by way of sensible content above 16kHz in most CD's or on prerecorded tapes.

The polar responses are quite impres-



Frequency response plots for the Image 3 system. At top are the driver plots measured at 5cm from each, followed by the system response measured at 1m and 2m on the tweeter axis, and at 2m but 30 degrees off the tweeter axis.

sive, with no significant loss of directivity potential until 10kHz, and even at that frequency the drop is only -3dB or -4dB at 30° from the main axis.

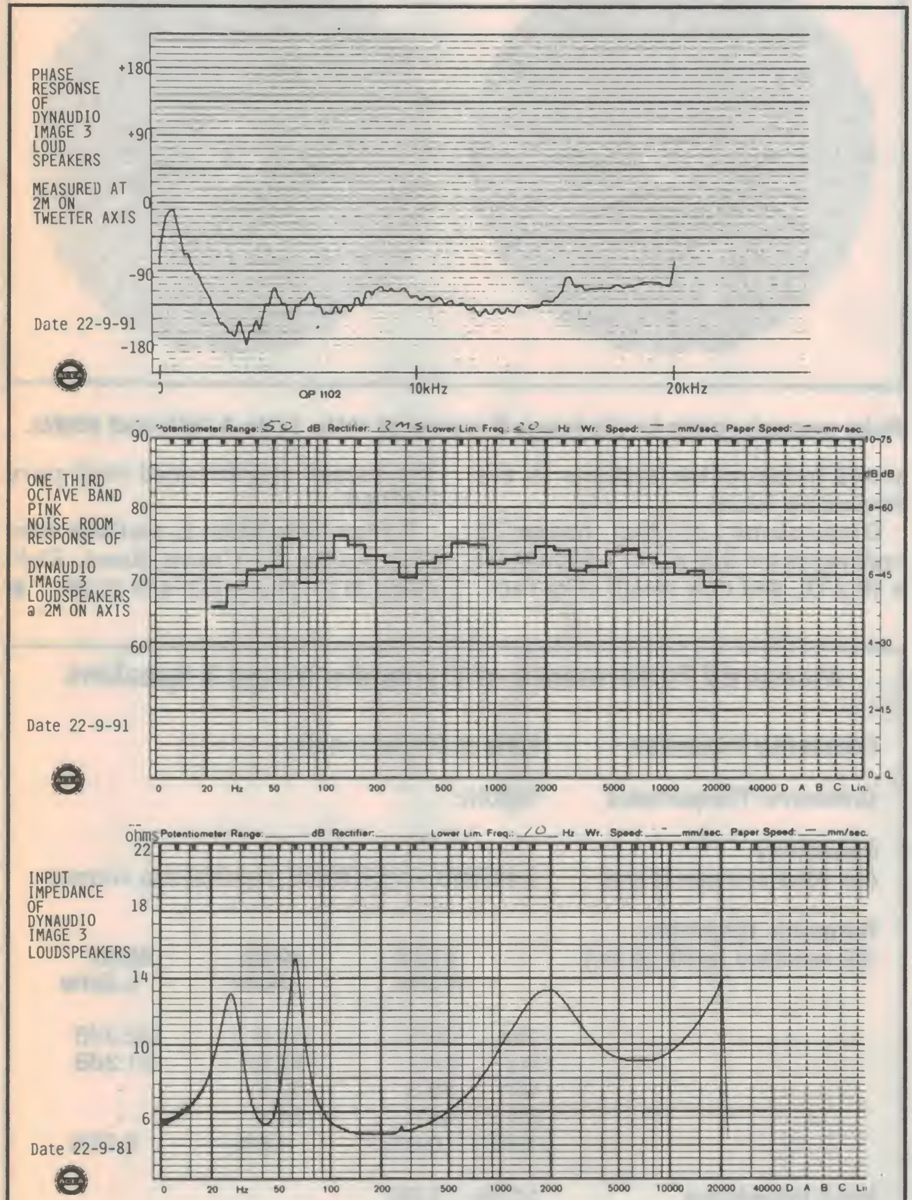
The polar response at 3kHz also features a slight improvement in output at 30° off axis, which can be simply described as a 'bright spot' in its output contour.

The tone burst characteristics of the Image 3 speakers is smooth at 100Hz, but exhibits some trace of ringing and carryover at 1kHz — which it should be noted is primarily a result of the interaction between the two drivers, in the region of the crossover frequency.

At 6.3kHz there is only a minuscule level of ringing, which is just detectable in the decay response spectra. The decay response spectra confirm modest resonances at 3kHz and 5kHz, and one relatively sharp and prominent resonance at 16kHz, which is just detectable on some program content. Although I must acknowledge that I had to look and listen for it, to find it.

The decay response spectra also confirmed that there is a prominent low frequency resonance, which did not show up as noticeably in the anechoic frequency response tests.

In addition the cabinet resonances are more readily detectable in this evaluation than they are by any other objective test — short of placing accelerometers on the cabinet and carrying out either a modal analysis or comparable resonance analysis.



In these three further plots we see the system phase response measured at 2m on the tweeter axis, the one third octave pink noise response (same distance) and finally the input impedance plot. Note the peaks at 25Hz, 60Hz and 2kHz.

The measured phase linearity characteristics of the Image 3 are remarkably smooth, and appear to be a credit to Glen Leembruggen's talents.

The measured impedance characteristics of the speaker display three prominent peaks, the first of which is at 26Hz, the second a shade over 60Hz (and about which I will have more to say later) and the third at 2kHz. The lowest impedance of the speaker is a shade under 5 ohms, and that impedance would appear to be the representative load impedance of the speaker.

Consequently the Image 3's are best used as a single set of speakers on your amplifier's output terminals, if you wish to avoid the possibility of overloading the amp's output stage.

As the Image 3's do not incorporate a protection circuit, it would be advisable to either incorporate an external set of fuses or one of the electronic protection circuits of the type which are advertised as kits from the suppliers in this magazine.

The last objective test was the one-third octave band pink noise room response test of the Dynaudio Image 3 in my living room, and apart from the merest suggestion of a resonance at 63Hz, the pink noise response of the speakers is quite outstanding.

Subjective evaluation

Having evaluated the objective characteristics of the Image 3, and with my real-time analyser still set up to monitor the characteristics, I proceeded with the subjective evaluation.

The first disc that I used was Carlo Maria Giulini conducting the Royal Concertgebouw Orchestra in Dvorak's *Symphony No 8* (Sony Classical SK 46 670), which is a wonderful rendition of this beautiful symphony and which exercised most but not all of the classical musical reproduction characteristics of the Image 3's in a particularly impressive way.

Dvorak was an extremely talented composer and his Symphony No 8 provides a soft, gentle, lyrical piece in which virtually all of the major instruments feature — including the drums. I noted with interest that at each drum roll, the 63Hz resonance was most prominent.

I progressed to Murray Perahia playing *Franck & Liszt*, (Sony Classical SK 47 180), and in particular two of my favourite pieces, Liszt's *Mephisto*

Waltz No 1, and his Concert Study No 2, *Gnomenreigen*, which are equally complex tests of both the competence of the pianist as well as of the reproductive capabilities of the loudspeaker system.

Murray Perahia is one of America's foremost pianists, and although I have once heard a superior rendition of the *Mephisto Waltz*, the *Gnomenreigen* was brilliant, and the sonic reproduction was remarkably true to life. So far so good...

I progressed on to a second record of Murray Perahia, with Radu Lupu playing *Mozart Concertos for Two & Three Pianos*, backed by the English Chamber Orchestra (Sony Classical SK 44 915).

This disc is undoubtedly the most outstanding new Mozart disc that I have heard in 1991, and contains a brilliant selection of chamber music with duo pianist backing.

The Image 3's performed admirably, although I was readily able to detect some minor dissonances, as well as traces of distortion, particularly when the listening levels exceeded 100dB(A) to 105dB(A) at 2m or more from the speakers.

Once again I could both hear and detect the 63Hz resonance, and was both aware of it and regrettably starting to listen for it.

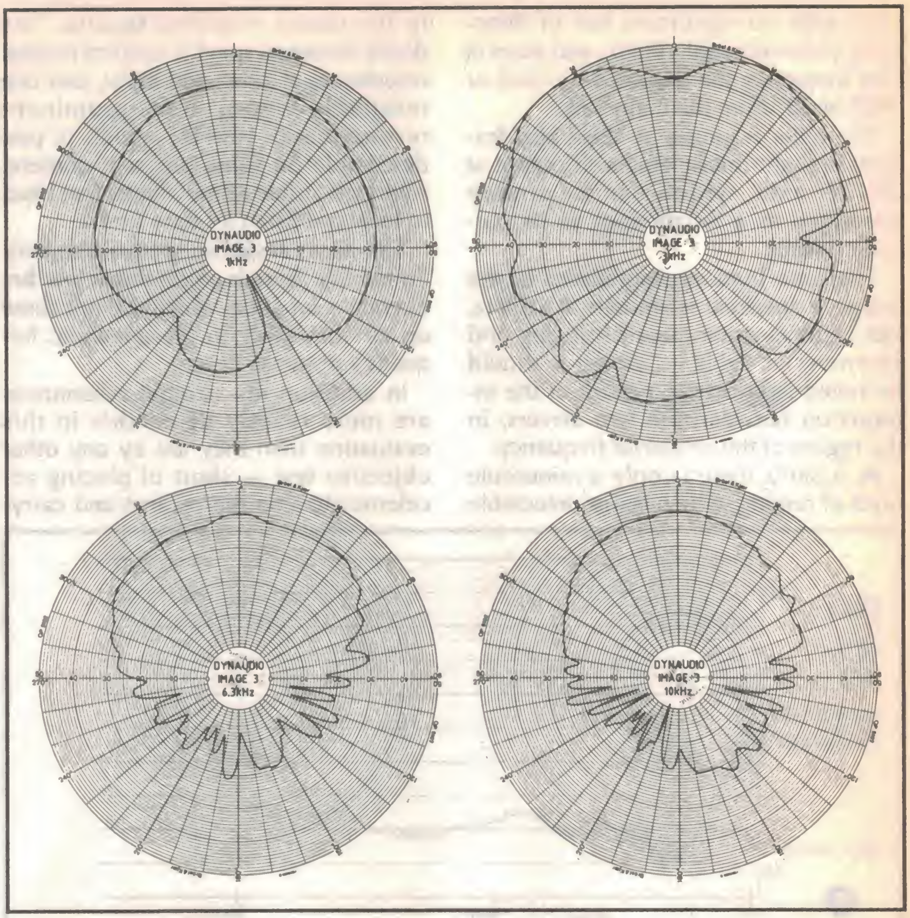
I progressed on to some rock music, and when the predominant content of the music suddenly changes to low frequency beats, you become acutely aware of the 63Hz resonance. It makes you start to wish that the porting structure had been simply modified by using a foam plug to broaden the bandwidth of that resonance, and reduce its amplitude.

My final series of subjective tests were of the voice reproduction capabilities of the Image 3's, and by and large, I was satisfied that although they have a detectable audible characteristic on voice, the voice reproduction characteristic was very commendable.

The Image 3's provide a credible performance when reproducing rock music, with significant low frequency and at high levels of output.

By contrast they provide an outstanding performance when reproducing classical music. This is clearly their preferred medium, and for it they are likely to be purchased in large numbers.

The Image 3's will undoubtedly set the yardstick for Australian designed small loudspeaker systems in the foreseeable future.



Polar response plots for the Image 3 system at 1kHz, 3kHz, 6.3kHz and 10kHz.

Dimensions of the Image 3 enclosures are 520 x 220 x 300mm (H x W x D), and they weigh 11kg each.

The quoted recommended retail price is $1690.

Further information is available from Scan Audio, 52 Crown Street, Richmond 3121; phone (03) 429 2199. ■

Measured Performance of Dynaudio Image 3 Speakers

Frequency Response	50Hz to 20kHz =/-4dB			
Crossover Frequencies	1500Hz			
Sensitivity (for 90dB average at 2m)	7.4VRMS = 13.7 Watts (nominal into 4ohms)			
Harmonic Distortion (for indicated levels @ 1m)		**87dB 100Hz**	**90dB 1kHz**	**90dB 6.3kHz**
	2nd	-20.3	-41.2	-42.3dB
	3rd	-34.2	-37.8	-51.3dB
	4th	-50.3	-57.5	-
	5th	-48.5	-64.0	-
	THD	9.9%	1.6%	0.77%
Input Impedance	100Hz	5.2Ω		
	1kHz	10.0Ω		
	6.3kHz	13.2Ω		
Minimum at 200Hz		4.7Ω		

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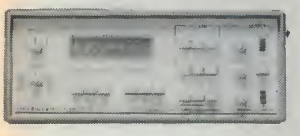

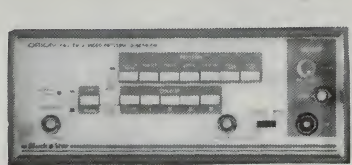

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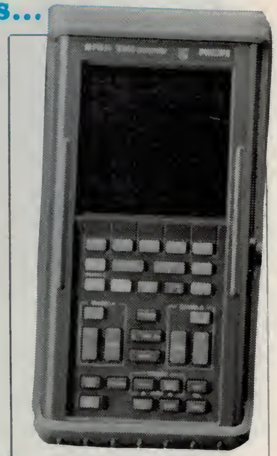

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Canon's EX1Hi, the first camcorder for the consumer to accept interchangeable lenses.

New Camcorders following two paths

Video camcorder makers are becoming increasingly adept at performing miraculous 'shrinks' of each new wave of models — while at the same time managing to crank up performance, and also hike prices by 50% or more. As 1991 draws to a close, it's useful to take stock of how far home video camcorders have now developed, in terms of design and features, and interesting to speculate where they seem to be heading.

by BARRIE SMITH

One thing becoming apparent is that camcorder designers — and their marketing people — are setting up two diverging product streams. One stream began when Sony's market-shattering Handycam TR55 appeared in 1990.

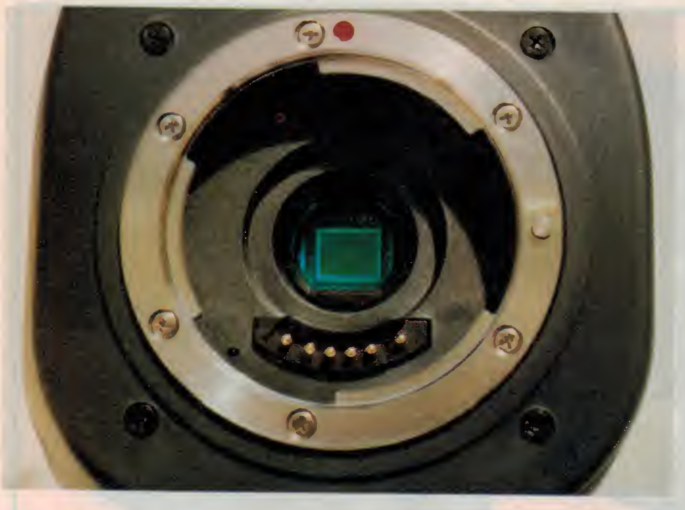
Since then nearly all of the major makers have come out with simpler, smaller, cheaper and more 'pocketable' units. Clearly these are to meet the two prime needs of Mr & Mrs Videomaker: family shooting, and holiday/travel.

However as these tiny video machines contract in size, so does the problem of camera shake increase in the hands of the less than expert user.

The physical constraints of a smaller package (necessitating smaller head drums and simpler transport paths) has also increased picture jitter. Only two companies have attacked the shake problem, and one alone has confessed and attended to the concern of picture jitter.

The second product stream has seen the larger camcorder remain, with most companies producing more high band (S-VHS and Hi8) models, with more bulk, more weight, more complex features and — wonder of wonders! — incorporating still camera operational approaches into these machines.

(Follow the 150-year-plus path of silver photography they may, but sometimes, video designers seem to have misunderstood — or ignored — the basic principles of optics and light!)



470,000 pixels have never been so naked as in this shot of the image sensor in Canon's EX1Hi interchangeable lens camcorder.

The EX1's body, with a 24mm SLR lens and the necessary adaptor.

Hefty Canon

Canon has produced the EX1Hi, the first camcorder in consumer terms to accept interchangeable lenses — just like a 35mm SLR; and it can also use Canon EOS still camera lenses. For the first time the way looks clear for the consumer (albeit a well-heeled one, with the EX1 priced at nearly $4,000) to have access to a camcorder which can use a very wide angle lens — in the form of a zoom with a 5mm minimum focal length. The EX1 belongs to the second stream: it uses the Hi8 format, with its over 400 lines of horizontal resolution and luminance signal bandwidth of 5.4MHz, and with the RGB signals from the CCD being processed separately before reaching the recording heads, improving colour reproduction. The CCD itself has a total pixel count of 470,000, reducing to an effective 440,000.

No lightweight, the camcorder weighs in at a hefty 1.4kg. Add a battery and a lens — the 15:1 zoom weighs in at 750g — and you arrive at a total of around 2.25kg. Exceptional optical and picture quality is the bonus, but patently the EX1 is not a model for the light-footed traveller.

Having mixed with the odd film and video newsreel cameraman over the years, I can attest to the fact that bulk and a little weight can sometimes be useful as barging and bargaining power in violent crowd activity: the EX1 fills this need!

Canon being a photographic company of long standing, their reputation as builders of durable cameras and lenses has been appreciated by both professionals and the keen amateur. This high band model, with its lenses alone weighing more than most mini palmcorders, confirms the tradition. An example of how the aforementioned 'streams' are heading in apparently widely diverging directions is in the materials and machining of the video hardware.

Plastic-bodied palmcorder models with integrated, fixed lenses are now heading down to half a kilogram in total weight. Even small savings in each component are important. Most manufacturers have brought palmcorder zoom lenses down to 50-60g in weight, and tape transports to 250g levels.

Optically, the EX1 may be the best current choice to satisfy discerning video makers with a photographic background.

The extremely long ranging 15:1 zoom (8-120mm) has an aperture of F/1.4-2.1 (depending on focal length selected) and a 15-element optical makeup, with 13 of these coated. The iris itself has eight blades, to restore circularity to highlights.

At launch time the latter zoom was accompanied by an F/1.4-1.8, 8:1 zoom (8.7-69.6mm) which weighed less than half that of the 15:1. Now a 3:1 zoom (5-15mm) has also been released.

Digital rendering off tape — made with the Art Freeze mode of the EX1.

Long, longer, longest!

In terms of long, long lenses the Canon redefines strikingly narrower horizons with its ability to use almost any of the EOS range of 35mm SLR lenses. An enlargement factor of 5.4 times comes into play when the SLR lens is fitted to the EX1, and can transform a 1000mm lens into the equivalent of 5400mm; the angle of view shrinks from 2.5° to approximately 0.5° coverage in the video viewfinder!

As if that were not enough, a two-times extender can also be fitted between the lens and camera body — giving the equivalent of 10,800mm or 0.25° angle of view.

Exposure control is well served by a correlated two-field system, using readings from the centre and perimeter of frame. The exposure level itself can be adjusted up or down in quarter-stop increments, with viewfinder confirmation.

The shutter runs to 1/10,000, and there is a Gain Up mode so that the full range of speeds can be thoroughly exploited.

EX1 in digital

Panasonic's S1 mini camcorder was first to incorporate a still frame function, presumably to 'mix it' with the still-video cameras hesitantly approaching the market.

The EX1 follows this, and like a num-

ber of other camcorder models at the lower end of the market, the EX1 offers digital image processing via a frame store.

A 'freeze' mode captures a still image, yet the audio keeps recording. You can also record blur, via a series of 1/6th of a second freezes of continuing action. Art Freeze produces a series of still frames with a 'paint' or posterised effect. Dissolves are also possible in Overlap mode: the outgoing scene's image is frozen during the dissolve. A two times digital enlargement of the scene — but with quite noticeable quality loss — can be accessed in Close Up mode.

Simpler models

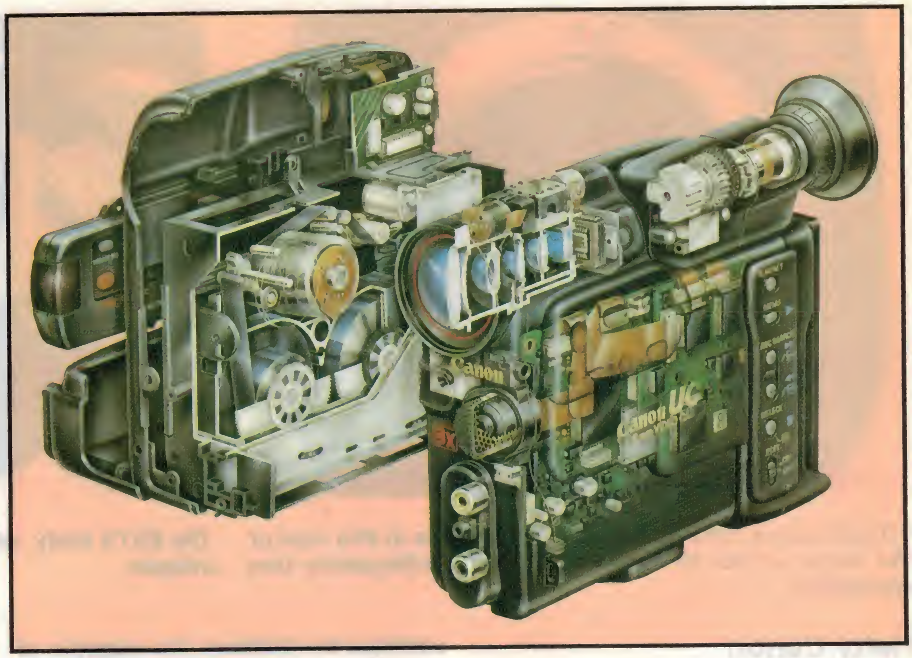
Not content to sit at the upper end of the market, nor play the technology game, Canon has also recently introduced smaller and simpler to operate 'Mum and Dad' models. One is the UC10, with a zoom wide end of only 6mm, and a low-light potential of a mere 3 lux. Slimming the camcorder's body to a mere 79mm, this model weighs in at less than 600g (minus battery).

Novelty value is served by the E850 (weight 1.25kg) — another Hi8 model — which has a library of eight animated titles and six musical 'stings' or themes to glam up even the most tawdry piece of home video making.

How would you like a flock of butterflies swinging away to the tune of *Sur le Pont d'Avignon? You've got it, with the E850!*

Wide Mitsubishi

Seeing the market's call for a lens arrangement offering more than the fixed zoom, Mitsubishi in Europe has introduced a PAL camcorder — the C35 — which can accept interchangeable front elements to give a variety of focal lengths.



Cutaway of the Canon UC10, a budget priced small camcorder. Lens weight is less than 50g.

Optically, the preferred position for lens extenders and converters such as this is *behind* the objective — not in front.

But in this case the glassware is designed to work with the main group and will appeal to many with its ability to provide a 5.9mm focal length. Sadly, we won't see this model in Australia.

Smaller, and launched recently in Australia, was Mitsubishi's line of three VHS-C machines. One of the camcorders was in Super-VHS-C, and all weighed in at just 690g — beating the new small Hi8 Sony model (see below) by a week or two.

The Mitsubishi camcorders are so light a digital stabiliser is installed to steady the hand, this time operating in both vertical and horizontal planes — unlike Panasonic's vertical-only approach in their S1 (see box: 'Shake removal — Panasonic vs Mitsubishi).

The high band HS-CX7 has a six-mode 'Event' system — Portrait, Sunset, Golf, Ski or Sports — indicating its target market is the average video maker wishing to gain an edge in quality. The 1/3" CCD image sensor has a pixel count of 420,000.

Canon's E850 — butterflies and 'Sur le Pont d'Avignon'.

Fast, faster

Returning to the high performance or 'large' end of the market, Panasonic has produced an S-VHS camcorder — the MS95 — which carries lens aperture data in the viewfinder in half-stop increments. The high speed shutter runs to 1/16,000 sec, with intermediate steps.

It's worth noting the relentless passion with which video pursues higher and higher shutter speeds, while the amount of light available is strictly finite.

With the MS95's lens wide open at F/1.7 on a bright sunny day, the fastest shutter speed that would produce an adequately lit image would be around 1/4,000 sec.

Stretching to 1/16,000 sec would see the image underexposed by two stops! Ultra high speeds will see image darkening, but perhaps motion analysis boffins can summon up the required volume of illumination.

Panasonic has had major success with its 'G series' of low priced units, but the MS95 will have considerable appeal to

Mitsubishi's CX7 — Super-VHS and an electronic stabiliser that steadies the pictured with claimed minimal quality loss.

serious video makers. At just over a kilo, it's another entrant in the 'hall of heft'. However, it has impressive specs. It uses an amorphous head and an FIT (Frame Interline Transfer) CCD.

Compared to a conventional CCD, the FIT CCD sends signals at high speed (50 times faster than normal) through the Vertical Transfer CCD to the charge storage section located underneath. The memorised signals are output through the Horizontal Transfer CCD. The result is virtually no smear in the imaging circuitry.

I did discover an undocumented feature in the 95, which should excite home video makers keen to do frame-accurate edits in post production: the inclusion of a VITC (Vertical Interval Time Code) generator.

The code generator works automatically without any prompting from the operator, allowing individual frame addresses to be encoded onto the tape, then later accessed, selected — and compiled to produce an edit list. However, not every VITC-able editing controller can read the MS95's type of VITC code. The 95 produces uses only two lines of the blanking signal for the code — the professional standard.

This aside, the exposure system in the MS95 would appear to be one of the best in a consumer camcorder — equal or superior to the exposure schemes found in Canon's EX1 or Sony's V5000.

And the big gain arrives when using the unit in Program mode, with the lens aperture working in concert with the shutter speeds — both able to change by subtle steps.

Still video

In Europe, Philips has surprised many by designing and producing a locally made S-VHS PAL camcorder model — the VKR9550 — after a long period of sourcing its units from JVC.

It is notable in being the first camcorder to carry an onboard VITC generator, and enters the volatile field of still video. The VITC inclusion is the result of collaboration between Philips and Panasonic.

The Dutch company has a financial interest in Alpermann+Velte, virtually sole producers of the all important chips. Importantly, the machine has a full AV line input, allowing it to be used not only to reproduce VITC-encoded signals, but take line inputs.

The still frame or ESP (Electronic Still Picture) feature depends, uniquely, on the 9550's ability to record a complete, single frame of action every 25th of a second. Normally, a camcorder shoots two fields to make a complete video frame, but access to only one of the fields (and consequent loss of resolution) has been possible until now.

The 9550 records complete frames every 1/25th of a second, which it then divides to a pair of fields for TV playback. VITC code is used to access the individual frames for replay. The result is a doubling of definition, further assisted by its 2/3" sensor chip.

Again this model is not for Australia, unfortunately, due to the need for a sophisticated service setup.

Panasonic's high level MS95 — half stop exposure changes, and an undocumented integral time code generator.

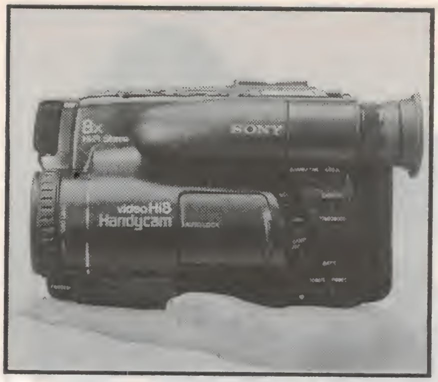
Camcorders

Top tiny

But the most talked-about camcorder of 1991/92 is likely to be Sony's new Hi8 TR705. Industry competitors have still not finished their bitter barking about Sony's premature introduction of the TR45 palmcorder earlier this year. Now, many cats will pursue even more pigeons as the TR705 offers even more in the customary minuscule package.

The direction of the price for this unit, as is the case with all fresh technological wizardry, is in the pronounced direction of UP. On the face of it, the Japanese seem to be becoming increasingly adept at performing miraculous 'shrinks' of each new wave of electronic picture paraphernalia, bedecking them with more beguilingly attractive features — yet managing to hike prices by 50% and more.

In 1991 Australian companies saw demand dry up because of the recessionand the Gulf War. Old stock lingered in warehouses, while new models queued for release — the Japanese dislike price cutting. Now, prices have fallen and buyers show signs of returning. Possibly by coincidence, Sony forestalled a possible price war by introducing a radical new model —



Sony's tiny but powerful TR705 — around 800g, but offering Hi8 format. One to watch in 1992.

helping to 'ramp up' prices by delivering added value features such as high band recording.

The TR705 is physically almost identical to its standard TR75 equivalent, yet is slated to sell for around a thousand dollars more.

How? Because it is in Hi8 format, and has some appealing features such as a combination aperture/gain control which has full viewfinder indication of what is happening. Small, and weighing little more than 800g, the Sony is a technological masterpiece of miniaturisation. A redesign of the tape path is claimed to cure picture instability — a little- known bane of small designs.

Over 400 lines of resolution is one benefit, aided by an effective 440,000-pixel CCD. Using a 'Cat's Eye' CCD, the camcorder can also pick up images as low as 2 lux — roughly the light of a small candle. The auto focus is also a very rapid one, able to pull from infinity to 1cm in a second or so.

Then, to add a touch of the jet set to the whole tiny package, the 705 has a world time/date function, allowing you to dial in local time so that your tapes carry the exact moment and day your international video action was seized.

What's next

The format wars — Video 8/Hi8 vs VHS/S-VHS/VHS-C — look likely to continue until 1996, in which year the industry is expected to release consumer digital video to the awaiting videographic hordes.

Analog will be dead — officially. Linear tape may also be presumed lifeless at this time.

The recording medium to replace tape could well emerge from at least three technologies already in the pipeline: Sony's 2.5" MD photo-optical disks, Philips' DCC cassettes and the little known ICI 'Digital Paper'.

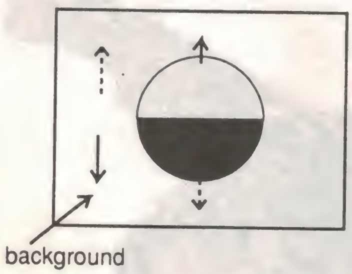
All have immense storage potential, with similarly small bulk in the media itself. ■

Shake removal: Panasonic vs Mitsubishi

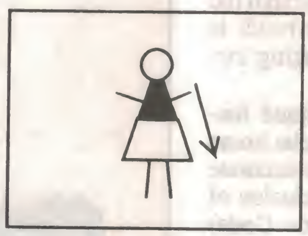
The smaller the camcorder, the greater the chance of operator-induced shake — an inescapable fact. Panasonic's pioneering stabilising camcorder — the S1 — uses comparative analysis of consecutive frames, a frame store and correction algorithms to produce a steady video picture. Unfortunately, the system is unable to distinguish between a shaky hand and a shaky subject! Odd motion artefacts occasionally cause some interesting effects, and an overall picture quality loss of around 15% is another penalty.

Mitsubishi's approach is to detect the physical instability of the camcorder itself — in vertical and horizontal directions. It then converts this information to electrical impulses, and applies this data directly to the CCD signal before it reaches the record heads. Little or no picture degradation is claimed, and odd motion artefacts are not introduced.

The accompanying diagrams describe how Mitsubishi sees the problems in Panasonic's method. The writer felt it unnecessary to show Mitsubishi's steady picture. After all, 'steady' is steady!

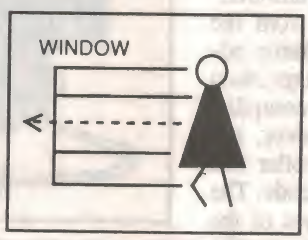


Even where there is no hand shake, a high contrast subject moving in the foreground causes the background to move in the opposite direction.



When a high contrast subject, eg a person, moves closer to the camera, the background shakes.

A person who turns abruptly in the frame, is seen by the non-Mitsubishi stabiliser as camera shake, causing the whole picture to shake.



When a person passes in front of a bright background, eg a window, the non-Mitsubishi system causes the whole image to shake.

The Panasonic method of image stabilisation — as assessed by Mitsubishi.

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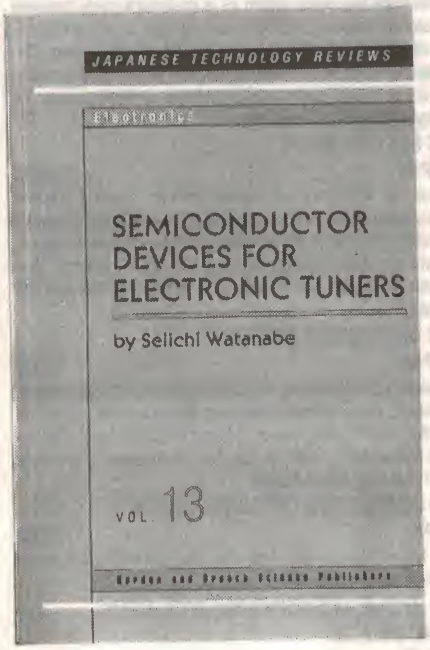

The RS-232C maze

RS-232 MADE EASY, by Martin D. Seyer. Second edition, published by Prentice Hall, 1991. Soft cover, 230 x 150, 436 pages. ISBN 0-13-749854-3. Recommended retail price $51.95.

Like the first edition of Seyer's book, this new edition is designed to give the reader a good, solid understanding of the ins and outs of the still very widely used RS-232C serial data interface. The book has now been expanded to include a chapter answering the most frequently asked questions about serial connections, plus pin connections for more than 800 devices in the appendices.

The book seems to be written more for the novice than the expert — an elaborate analogy is drawn between movement and control of a railway system and data communication via the RS-232 interface. This analogy is very well developed to introduce all the common technical terms and concepts. But the very extensive appendices (13 in all), which make up over 75% of the book, provide the information for anyone to design their own interconnecting cables for almost any situation.

Chapters 1-2 introduce the need for a communication standard, and explain the meanings of common jargon like 'simplex', 'half-' and 'full-duplex', and asynchronous vs. synchronous communication. Chapters 3-5 explain the operation of modems for asynchronous communication, the advantages of 'dedicated' or permanently leased phone lines, and synchronous environments with their controlled timing rates.

Chapter 6 covers secondary signals and flow control, while chapter 7 explains the cross connections for 'null-modem' cables used to directly interconnect devices over distances of up to 15 metres. Finally, chapter 8 answers the questions most commonly asked of suppliers and installers of serial communication systems.

I found the book very easy to read and understand — it will be a great reference next time a cable has to be made up for RS-232 devices. The author's use of the 'train line' analogy seems to me especially effective in explaining the meaning of communications jargon, much of which can be off-putting until you become familiar with the actual concepts involved.

The review copy came from Dick Smith Electronics. It is currently available from DSE stores (catalog No. B 6098) at a special introductory price of $49.95. (P.M.)

Japanese technology

SEMICONDUCTOR DEVICES FOR ELECTRONIC TUNERS, by Seiichi Watanabe. Published by Gordon and Breach Science Publishers, 1991. Soft cover, 215 x 140mm, 142 pages. ISBN 2-88124-475-0. Recommended retail price $US70 ($US35 for Science and Arts Society members).

This is volume 13 in an ongoing series of monographs designed to inform the rest of the world of progress by Japanese researchers in leading edge technology. The topic in this case is devices for electronic tuners — tuning diodes, band switching diodes, amplifying devices and their system circuit design. Such tuners are widely used for VHF, UHF and CATV channels because of their superiority in terms of size, speed of tuning, reliability and integration of additional functions such as channel memory and remote control.

Chapter 1 covers the evolution of electronic tuners with their low distortion and low-noise characteristics; chapter 2 then covers the analysis, design and fabrication of the voltage-variable capacitance diodes which do the actual tuning; chapter 3 deals with the design and fabrication of band-switching diodes for channel selection; chapter 4 the front-end RF amplification by dual-gate MOSFETs and the use of GaAs MESFETs for UHF signals, with their improved noise figures but inferior cross-modulation; and chapter 5 gives a description of monolithic ICs functioning as mixer and oscillator with an impedance-matched output.

As we have come to expect from this series, this new volume is very thorough and technical, but at the same time well written and clearly illustrated. A very informative and useful volume for anyone interested in this (admittedly rather specialised) area.

The review copy came from Gordon and Breach in New York, but the book lists their Australian address as Private Bag 8, Camberwell Vic 3124. (P.M.) ■

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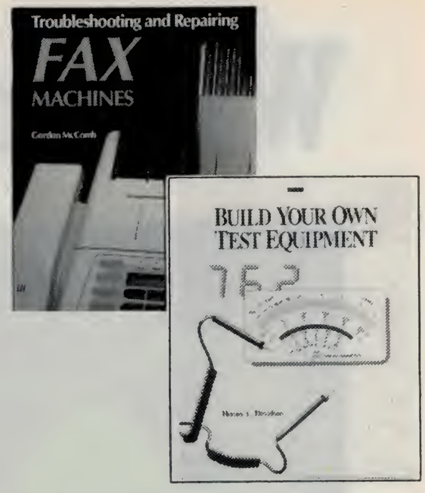

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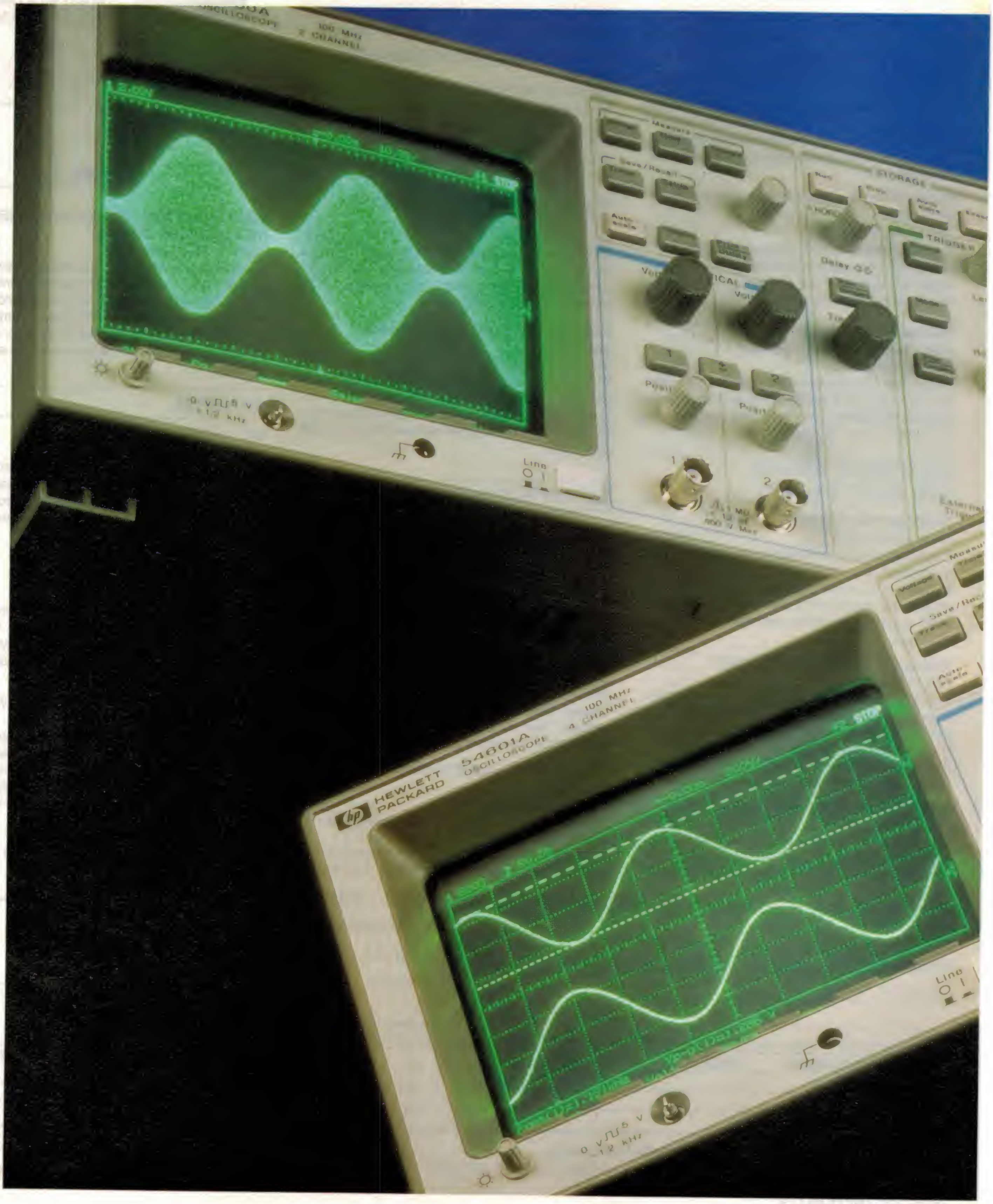

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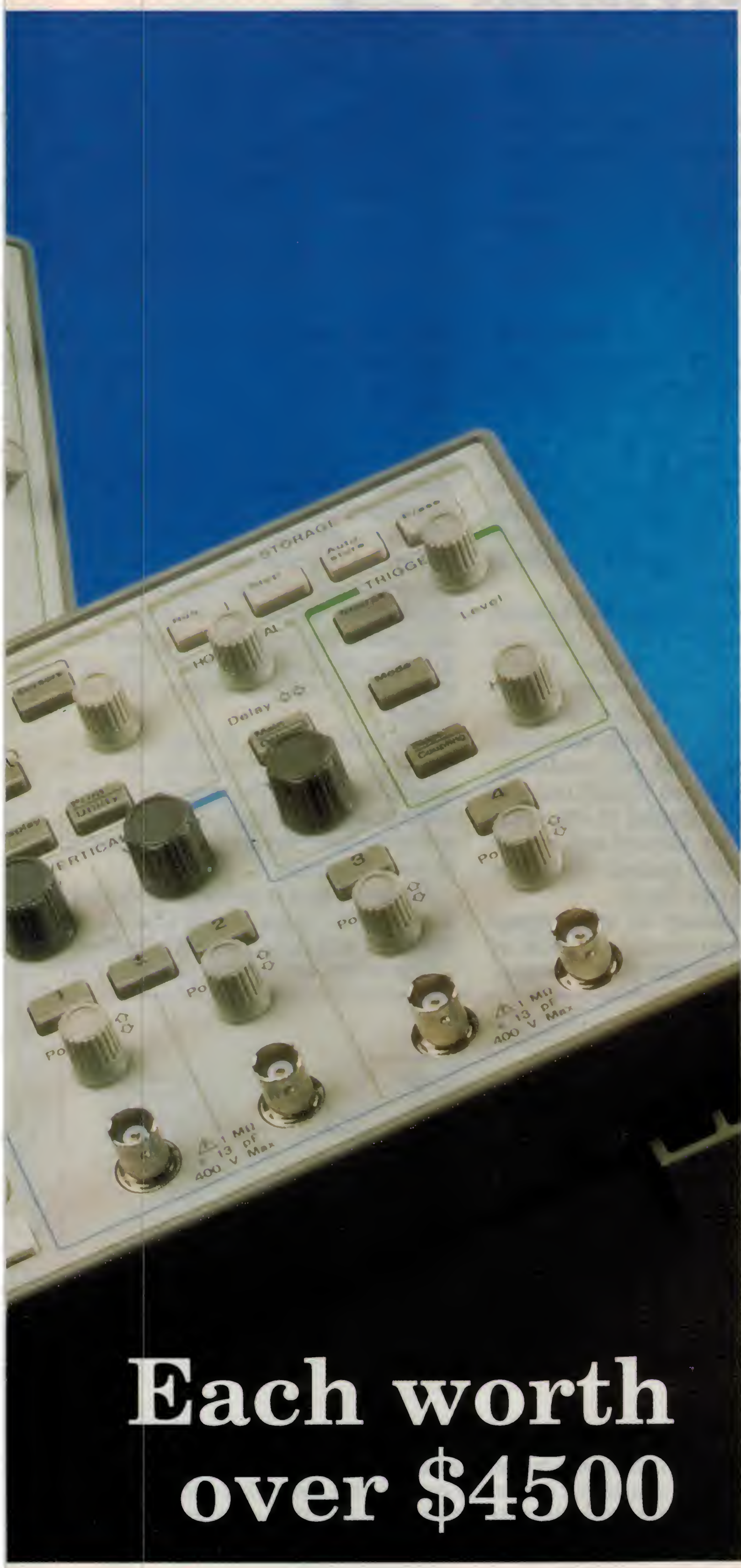

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HEWLETT PACKARD

Our evolving network of communications - 2

In this second of his articles describing the new technologies that are being introduced to our telecommunications networks, the author looks at SS7 'common channel' signalling and some of the 'Intelligent Network' services that it can be used to provide. The telephone companies expect such services to become both popular and lucrative, in the near future.

by ROBERT OWEN

The part of the telecommunications network whose upgrading is having the most wide-ranging effect on the network is in itself invisible to the telephone user. This upgrade is in the signalling method used between telephone exchanges, to 'set up' and 'take down' calls.

The new system, called *Signalling System Number 7* or 'SS7' for short, is different from most other signalling systems in that the channel used to send call set up and take down messages is separate from the channel used to transmit speech.

With SS7, although the 64kbps voice channels used to transmit voice or data are still reserved for the duration of the call, the signalling information necessary to set up or take down the call are routed between exchanges on a separate packet-switched network.

The physical circuits that the signalling packets take are called *signalling links*, and need not follow the same geographic path as their associated voice channels, as shown in Fig.7. Because the signalling links transmit packets of data, and because the amount of signalling per call is small compared to the duration of the call itself, signalling information relating to the connection of thousands of 64kbps voice channels can be multiplexed onto one signalling link. In practice though, several signalling links would be used in parallel in case one link failed.

Although the signalling links between nodes will usually closely track the voice circuits that they control, a more complex and powerful network is being developed. Additional nodes called *signal transfer points* are being introduced into the network, which only handle signalling links. These signal transfer points will be connected to the nodes that handle voice circuits and can be used to route SS7 packets should the direct links fail (see Fig.8).

Another advantage to using signal transfer points to control the flow of SS7 packets is that the people responsible for both network planning and day-to-day operation and maintenance can take a more global view of the network.

This is quite different from today's telecommunications network, where each telephone exchange is more or less an isolated island.

Using a separate signalling link for call set up information allows for faster call set-up and a more efficient use of the network. But this on its own would not justify the enormous expense that the telephone companies are now spending in order to deploy SS7 signalling.

The driving force behind the introduction of this system is that telephone companies will be able to offer many more services to the user, and these new services are expected to be very lucrative.

An example of a new service depending on SS7 signalling is CLASS, or Custom Local Area Signalling Service.

One of the advantages of using SS7

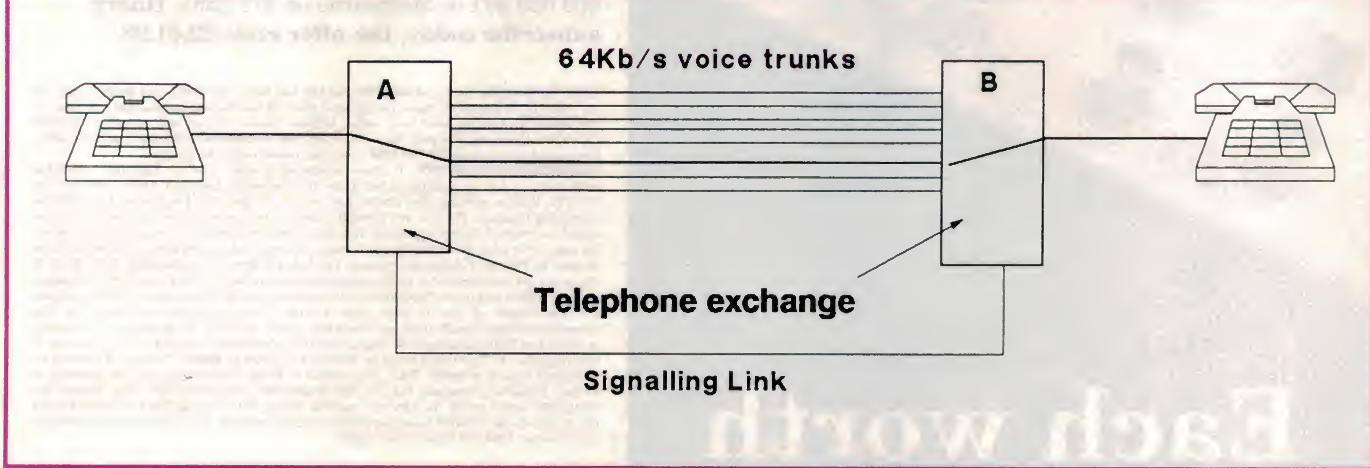

Fig.7: Signalling system number 7 uses a separate signalling link between telephone exchanges, over which is sent packet data used in the first instance to set up and take down calls. A single link is used to convey this signalling data for a great many calls. The advantage of this system is that the common signalling channel can be used for other information as well.

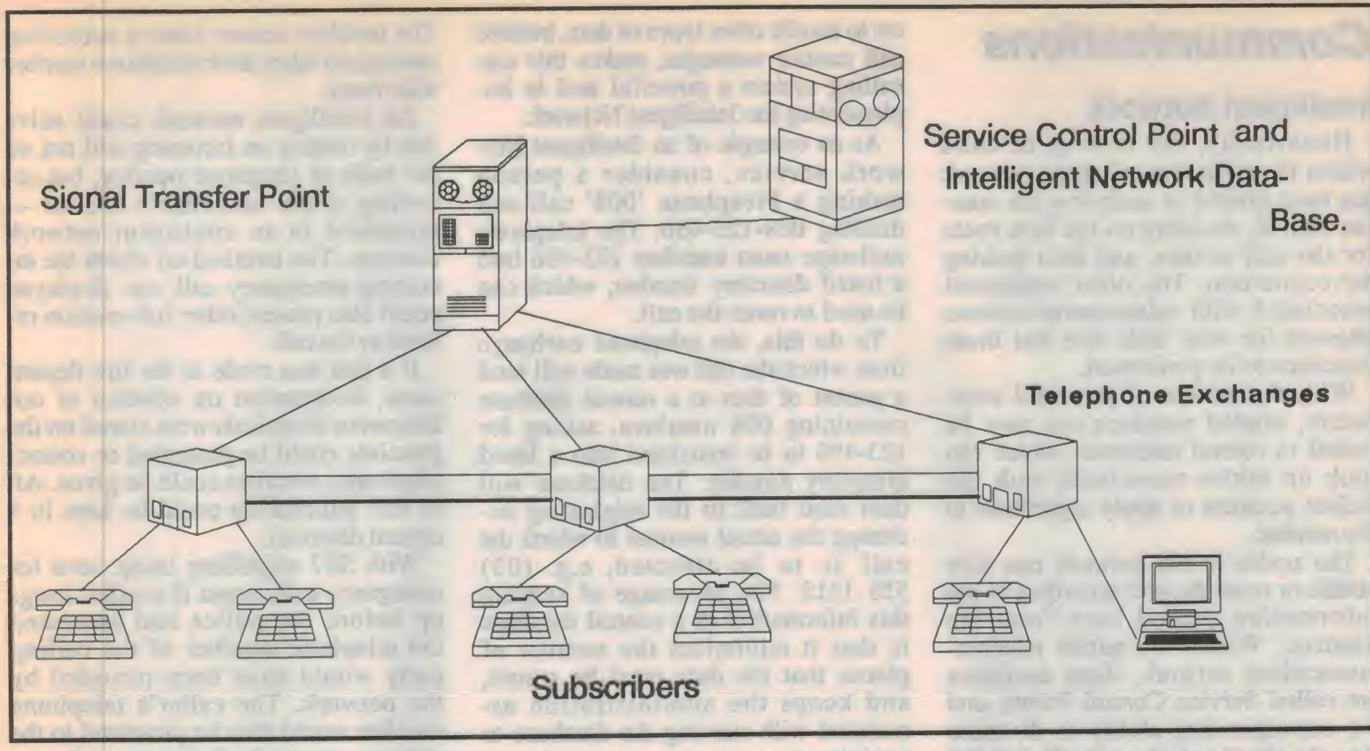

Fig.8: In the proposed future configuration of the network, the SS7 signalling links will be used to link all of the exchanges with signal transfer points and service control points, to provide an 'intelligent network'. This will provide additional services such as caller identification and automatic call re-routing.

packets to set up a call is that the packets can contain a large amount of information not previously transmitted with the call set up information in older signalling systems. An example would be the telephone number of the person making the call.

Subscribers can purchase or rent phones that display the calling party's number. The calling number is transmitted from the called party's exchange to his or her phone before the first ring, using tones similar to computer modem tones.

Knowing the telephone number of the calling party allows the called party to look at the display on the phone and to select the calls that they wish to answer.

Alternatively, this can either be done by purchasing a more sophisticated phone and programming the phone to accept only calls from certain numbers, or to pay Telecom a fee and to leave the call selection to be performed at the telephone exchange.

In either case, a table of calls that are to be accepted or rejected is assembled in software. Even if Telecom performs the screening at the exchange, the subscriber is still able to add or delete numbers from the list using the telephone in their home or office.

In addition to accepting or rejecting calls selectively, calls can be forwarded to different locations depending on who is calling. For instance, suppose a sales person who works partly from home goes on vacation. It will be possible for the subscriber to set up a call forwarding table associated with their home, as follows.

Calls from customers will be forwarded to their secretary at the office; calls from a daughter at college will be forwarded to their hotel in Queensland; a call from the builder who needs the key to their house will be forwarded to the next door neighbour; and all other calls will be sent to an answering machine requesting the caller to leave a message. The sales person can then call their home number, enter an access code, and get a playback of all the messages that have been sent.

Of course, in order to set up such a sophisticated call forwarding scenario, the sales person would need to know in advance the directory number of the phones from which the people would be calling.

As an alternative example, consider the following: a phone-in television show is screened nationwide. The first call to be accepted is from Perth. The second call is now ready to be accepted, but the television show hosts would like the next call to come from New South Wales.

By changing the information in the call forwarding tables, the show hosts can alter the handling of incoming calls so that only a call originating from New South Wales will be accepted — other calls can be directed to an announcement.

Similarly, as the show progresses, the show hosts can further alter the information in the tables to accept subsequent calls from, say, Queensland or Tasmania. All this will be done without the viewers being aware of the selection process.

So far we have only discussed transmitting the calling party's number across the network. But the SS7 signalling system is flexible enough to transmit other data within the INFORMATION field of signalling packets.

In addition to delivering the calling party's number, the name of the calling party could also be transmitted for display on the called party's phone.

Alternatively, if the called party was not available a message could be sent back to the calling party saying, for example, 'Gone for lunch. Back at 2pm'. All this will be presented to the subscriber on a display phone or PC.

It is these kinds of CLASS services, made available by being able to deliver more useful information during the SS7 call set up, that telephone companies expect to become large revenue earners in the future.

Communications

Intelligent Network

Historically, the routing of calls within the telecommunications network has been limited to analysing the number dialled, deciding on the best route for the call to take, and then making the connection. The older equipment associated with telecommunications allowed for very little else but these functions to be performed.

With the advent of powerful computers, dialled numbers can now be routed to central databases, which can look up tables associated with the dialled numbers or apply algorithms to the number.

The nodes in the network can then handle or route the call according to the information passed back from the database. Within the public telecommunications network, these databases are called Service Control Points, and the corresponding ability to do more than the simple routing of calls has led to the development of a network architecture called the Intelligent Network, as shown in Fig.8.

In order to pass information from the network to the service control points and their associated databases, SS7 signalling links are used. The use of the INFORMATION field within SS7 packets to handle other types of data, besides call control messages, makes this signalling system a powerful tool in implementing the Intelligent Network.

As an example of an Intelligent Network service, consider a person making a Freephone '008' call and dialling 008-123-456. The telephone exchange must translate 123-456 into a listed directory number, which can be used to route the call.

To do this, the telephone exchange from which the call was made will send a packet of data to a central database containing 008 numbers, asking for 123-456 to be translated into a listed directory number. The database will then send back to the originating exchange the actual number to which the call is to be directed, e.g. (03) 555 1212. The advantage of keeping this information in a central database is that it minimises the number of places that the data must be stored, and keeps the administration associated with running the database to a minimum.

As an alternative example, the New York City Police Department splits up the region into approximately 200 local zones. An incoming emergency call to the police is screened according to the calling party's telephone number, and automatically directed to the appropriate police communications centre. The problem occurs when a subscriber moves and takes their telephone number with them.

An intelligent network could solve this by routing an incoming call not on the basis of telephone number, but according to the subscriber's address — contained in an intelligent network database. The terminal on which the incoming emergency call was displayed could also present other information related to the call.

If a call was made to the fire department, information on whether or not dangerous chemicals were stored on the premises could be presented or contact telephones numbers could be given. All of this information could be kept in a central database.

With SS7 signalling being used for emergency calls, even if a caller hangs up before the police had answered the telephone number of the calling party would have been recorded by the network. The caller's telephone number would then be presented to the police communications centre for an immediate response. This service can be provided today by other means; but without SS7, the present system is too expensive to be implemented country wide.

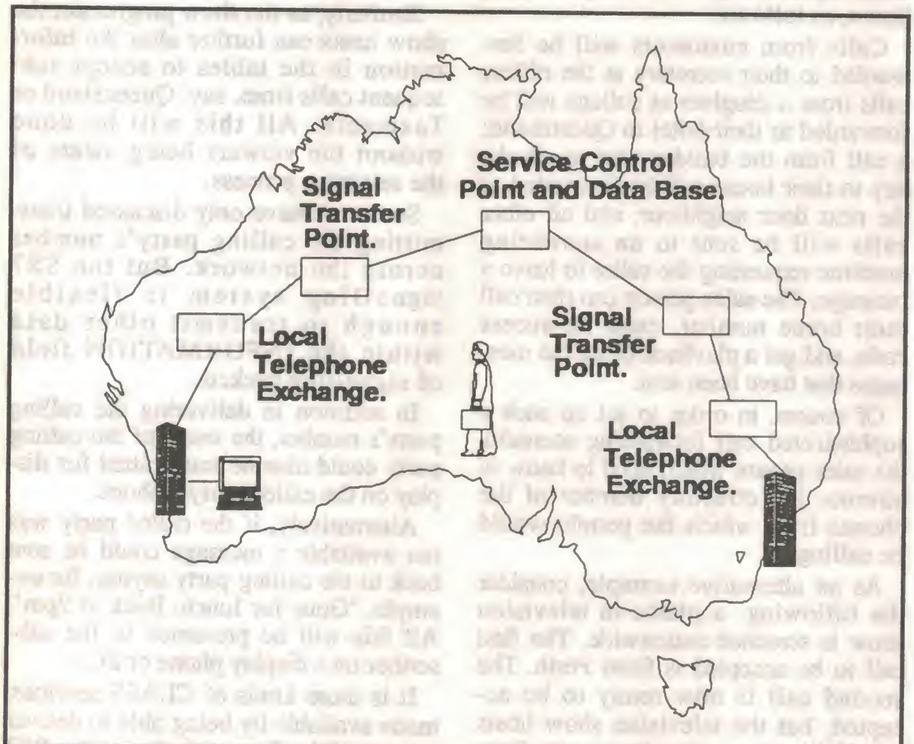

Fig.9: Using the intelligent network achieved using SS7, business travellers can be given a single telephone number. They can be contacted on this number wherever they move throughout the country.

Additional services

So far we have discussed some present uses of the Intelligent Network, but the Intelligent Network can provide many more services useful to the subscriber. As an example, consider people who take a portable PC with them when they travel, in order to communicate with head office.

When they reach their temporary destination they need to find a phone jack that is not being used; then they need to configure their PC to interface with the local telecommunications service; finally they need to communicate their new phone number to their business associates and family.

After perhaps a few days, they move on to another temporary location where they need to repeat the above procedure. All this is wasteful of time, and leads to delays in communicating with the traveller.

Using the Intelligent Network, a person can subscribe to a service called the Universal Personal Number and is given a special, unique directory number. This directory number stays with the traveller whereever they go nationwide.

Consider a business person who subscribes to this service and is given a directory number of, say, 765-4321. The

business person then buys a combined PC/telephone set. Inside the set is a PROM that contains a serial number unique to that set. This serial number is cross referenced within an Intelligent Network database to the subscriber's directory number, 765-4321. The subscriber now goes on a trip from Sydney to Perth, taking their PC/telephone with them.

In Perth, the person locates an unused telephone jack and plugs in. When the set is powered up, the telephone exchange to which the set is now connected automatically gets sent a message giving its serial number. This message is passed on to an Intelligent Network database, informing it of their new location.

From now on, nationwide, the directory number 765-4321 will be associated with the telephone port in Perth to which the set is temporarily connected. Any call to this person's office in Sydney will be automatically re-routed to the new temporary location in Perth, as shown in Fig.9.

When the set is powered up, the Intelligent Network database also transmits to the local telephone exchange the characteristics of the set. This data could include baud rates for data, the configuration of the keys on the set, or charging information. When the person turns off the power to the set, a disconnect message will be sent to the Intelligent Network database, cancelling the association between the directory number 765-4321 and the telephone port in Perth.

A person who now dials 765-4321 will get a recorded announcement, saying that the called person is not currently connected to the network. Voice mail or electronic mail could now be left, for delivery to the business person when he next connects to the network.

In order to reduce the loss due to the theft of these sets, each subscriber can be given a confidential identification number. After powering up the set, but before the set can be used to make calls, the user must enter the identification number for validation at a database. Alternatively, the database could keep a list of the serial numbers held in the PROMs of stolen sets. This type of service, available today with mobile car phones, will become common within the public switched telephone network during the mid 1990's.

In the third and last of these articles, we will look at the Integrated Services Digital Network or 'ISDN', and also its broadband enhancement.

(To be continued) ■

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by JIM ROWE

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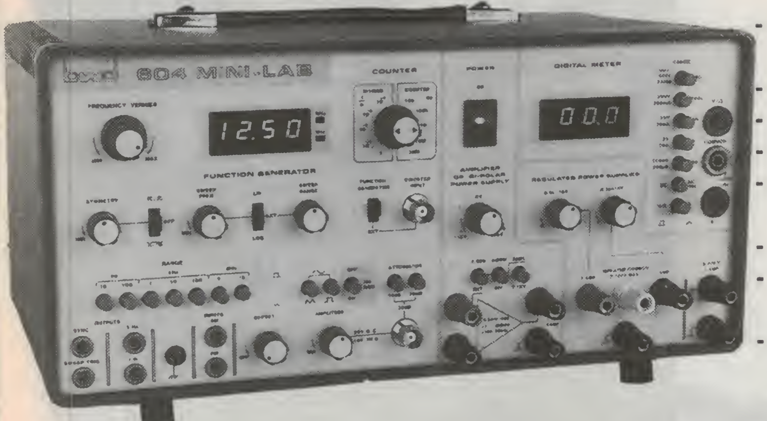
BWD604 MINI-LAB **By Mc Van Instruments**



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Product review:

DSE's versatile new 'Karaoke' unit

If you enjoy the increasingly popular Karaoke-style of 'sing alongs' as entertainment, this novel box of tricks should be just the shot. As well as offering a number of clever Karaoke functions, it can also act as a portable cassette player, mini PA system or AM/FM radio.

For those readers who may not be familiar with the idea behind the Japanese-coined Karaoke concept, it's essence is really quite simple: you just sing along with popular recorded music, which has had the main vocal track removed. This is usually done as a social form of entertainment, with others taking their turn for a share of embarrassment or glory, or simply providing appropriate encouragement from the sidelines.

To make the process more realistic, the Karaoke vocalist uses a hand-held microphone which has its output signal blended in with the pre-recorded backing music, which is in turn applied to an amplifier and speaker system.

While this is all that's required for the most basic Karaoke system (providing you have access to recorded music with the lead vocals removed), this new unit from DSE provides much more...

As you can see from the associated photos, the 'Ensing' Karaoke system is a rather unusual looking device. The box itself measures 320 x 170 x 170mm, with the 'front' panel holding a cassette player mechanism and most of the user controls. The 'rear' panel provides the speakers (a 120mm woofer and 60mm tweeter), mounted behind a protective grill, while one of the side panels is used to house the remaining controls and connectors.

The unit can be powered by internal batteries or from an external plugpack. It can also receive signals from a radio microphone (as well as from two normal microphone sockets), and amplify signals from a variety of sources. It's literally a self-contained portable Karaoke unit, and offers all of the components necessary for a full Karaoke session in a single compact box.

How it works

The most unusual thing about the Karaoke unit is the way in which its various components interconnect. For a start, the cassette player mechanism is equipped with stereo playback heads, yet the unit is essentially a monophonic system with only a single amplifier/speaker combination.

This arrangement takes advantage of specialised Karaoke cassettes which have been recorded with the lead vocal track occupying the tape's right channel, and the main 'backing' music fully panned to the left channel.

The idea of these tapes is that if you wish to sing along with the backing music only, you simply select the signal from the cassette's *right* channel and mix your own vocals (from the microphone) into the music at an appropriate level.

Conversely, you can isolate the lead vocal part by monitoring the tape's *left* channel, for when you need to clearly hear the lyrics and vocal style of the original singer. As you would expect, the two channels can also be simply added together (mixed) when you want to hear the song in its complete form.

The Ensing Karaoke unit can be switched into this channel selection mode by pushing the STEREO/-UTAOKE button on the front panel to the UTAOKE position, where the associated VOICE/MUSIC switch simply toggles between the voice and music signals (or the right and left channels, respectively). When the STEREO mode is selected on the other hand, the two channels are just mixed together — which passes both music and vocals to the output.

The remaining Karaoke function button on the unit's front panel is labelled VOICE/CANCEL, which when in the CANCEL position, places an 'active' attenuator circuit in the path of the right (vocal) signal channel.

This rather clever arrangement allows the signal level at the microphone input to inversely control the volume of the vocals from tape, so that each time you sing, your own vocal sound automatically replaces the original.

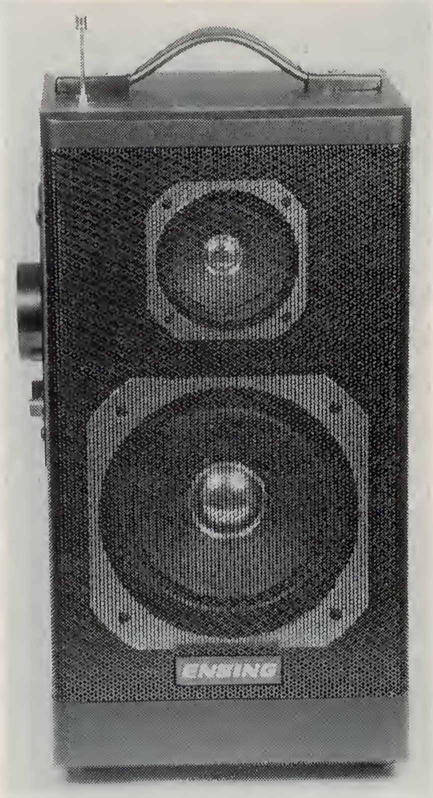
In fact it's not unlike the vocal 'ducking' process commonly used in commercial radio broadcasts, where as the announcer speaks into the mic the level of the current sound (say, music or even a telephone caller!) drops by a substantial degree.

In the case of the Karaoke circuit however, the sound from the tape's vocal track is completely attenuated, and only the microphone signal is heard. Presumably, this allows the user to practice along with the original vocal track without having to continually press the UTAOKE/STEREO button.

Controls & features

The other front panel controls are a little more conventional, with volume, bass and treble adjustments for the overall sound, and mic and echo level controls to help the user to 'blend' the microphone signals into the main music.

There are two 6.5mm mic input sockets, where both signals are simply mixed together and therefore equally effected by the mic controls (echo and volume).



The unit's 'rear' panel showing the internal tweeter and woofer speakers. Note the telescopic antenna on the top panel.

Judging by the sound produced by the internal echo unit, its circuit is probably based around a 'bucket brigade' delay line device (BBD), which tend to present a rather bouncy, but nonetheless useful echo effect.

Towards the top of the unit's front panel are the programming buttons and indicator LEDs for the cassette player's Automatic Program Search System (APSS) function. This allows the user to both skip and find songs on the tape, by programming in the number of signal 'gaps' (one between each song) to be passed over by the cassette mechanism, when FFWD or REW is engaged while a tape is playing.

To select (say) four gaps to be passed, you just repeatedly push the SET button until the LED labelled '4' is illuminated, then after the player has passed the four signal gaps it drops back into the play mode, and the song immediately following the last gap will be heard.

Also, the program count can be instantly reset (returned to one) by pushing the CLEAR button. All in all, it's quite a useful feature for a Karaoke system since it will automatically find the start of the desired song, without the user having to shuttle the tape backwards and forwards with the cassette player's keys.

The unit's side panel holds the remaining controls and connections; these are a large tuning knob for the AM/FM radio section, a band and function select switch, a volume control for the radio microphone mode, RCA-type sockets for an auxiliary audio input (left and right), and the DC-input connector for an external plugpack.

To change the main signal source for the Karaoke unit the BAND SELECTOR switch offers four positions, which are labeled AM, FM, CASS/AUX, and CASS/AUX/WIRELESS. While the AM and FM positions simply pass the radio signal to the output as you would expect, the two latter options allow more than one input source to be heard. For example, the CASS/AUX position is used for listening to signals from both the cassette player *and* those from the AUX input sockets.

It's interesting to note that the unit's dedicated Karaoke functions, such as the UTAOKE channel switching system, will also work with the auxiliary (AUX) input. So if a signal at the AUX input was arranged in the Karaoke fashion (vocals and music recorded in the right and left channels respectively), you could sing along with this external source in the usual manner.

While they are rather thin on the ground in Australia, there are specialised Karaoke laser discs available which not only have the required channel arrangement, but offer a video signal which is used for displaying the song's lyrics in real time.

In fact, this 'software' forms the

DSE 'Karaoke' unit

basis of the system in many of the so-called Karaoke Bars.

Getting back to the Ensing Karaoke unit, you may have noticed that the last position of the selector switch is nominated as an auxiliary, cassette and '*wireless*' input. This allows an FM radio microphone to be used instead of (or as well as) those connected to the two mic sockets, for a 'cable-free' Karaoke performance.

In this case, the radio is switched into FM (mono) mode and its output signal is passed through the WIRELESS MIC-VOL control, which independently sets the volume level of the radio mic. All FM signals, by the way, are picked up via a small telescopic antenna mounted into the top of the Karaoke unit's case.

Singing along

Using the Ensing Karaoke system is pretty straightforward, once you understand how the various controls change its function. Unfortunately, the supplied manual is only of limited assistance in this regard, as it seems to have suffered badly during the Taiwanese to English conversion; the result is perhaps more humorous than helpful.

Nevertheless, once you've popped in an appropriate Karaoke tape, plugged in a microphone and hit the PLAY button, you're ready to go.

The UTAOKE function allows you to swap between the vocal and music channels at the touch of a button, while the 'cancel' mode of the VOCAL/-CANCEL switch replaces the original singer's voice with your own in a smooth and predictable manner. All in all, the unit's Karaoke functions work very well.

The only real problem we encountered with Karaoke sessions was the tendency for the unit's mic preamp to overload with a strong (read: 'loud') singer, or if the microphone was held too close to the vocalist's mouth.

We initially suspected the quality of the rather lightweight microphone supplied with the Karaoke system, however an alternative mic produced the same results. The general message is: don't sing too close to the mic.

The system's amplifier/speaker combination produces a surprisingly clean and strong sound, considering the restrictive nature of the system's power supply (nominally 9V) and speaker enclosure (the Karaoke unit's own rather lightweight box).

When pushed to its limits by a deep and resonant male voice however, many of the parts which are screwed into the box (such as the cassette mechanism) began to buzz and rattle quite loudly.

If the unit is to be mainly used as a radio and tape player, it should fulfill this role quite well. The AM/FM radio reception and tape replay quality is typical of most radio/cassette units, and should be more than adequate for most users. Bear in mind however, that this role is a little restricted because the unit is orientated towards its Karaoke function — that is, it's a mono system, and

The side panel holds a large radio tuning dial, the unit's mode controls and the external connectors.

the tape player doesn't have recording capabilities.

As a mini portable PA system, the Karaoke unit also gives quite a reasonable account of itself. The ability to handle up to three microphones (including the radio mic), and its capacity for a relatively high acoustic output makes the unit quite suitable for birthday party announcements, 'spruiking', and so on.

Above all though, it's intended to be a versatile Karaoke system. In this regard, the Ensing Karaoke system does its job very well, and offers a number of clever little features as a bonus.

Software and hardware

Before you can enjoy a true Karaoke session you will need a number of appropriately recorded tapes, of course. No problem here, since those forward-thinking people at DSE can offer you a choice of some 19 Karaoke tapes, in around five different styles.

Each tape holds around 10 popular songs which have been re-recorded for the Karaoke format, and are not performed by the original artists — the idea of their voice being 'replaced' in a Karaoke system may not appeal to some of the more established singers!

The actual style of tapes range from older 'classic' hits ('New York, New York', etc), to more contemporary 'pop' songs such as those currently occupying the radio 'music charts'. Note that you are unlikely to find a title like 'Joan Sutherland's greatest hits'...

A number of these tape packages offer *two* cassettes; one in the normal Karaoke format, and another which has only the backing track (and no vocals) for each song recorded in true stereo. Alternatively, some of these double-packs simply have a spare blank tape, while the Karaoke version of the songs are on side one of the other tape, and the 'vocal-less' stereo recording on side two. By the way, the double-tape packs are priced at $19.95 and are available in five variations, while the remaining 14 single-tape packs are valued at $14.95 each.

On the 'hardware' side of things, the Ensing Karaoke system is priced at $249, which includes the matching microphone and a DSE 12V/1A plugpack to power the unit.

You will need to take some care with the plugpack wiring however, since it includes one of those small in-line plug and socket sets for swapping the polarity of the DC output. While these make the plugpack itself a little more versatile, it's rather easy to end up with the wrong polarity at its connector plug, which can in turn severely damage some equipment. However, the answer is simple; glue or tape it permanently together.

Needless to say, all of the above is available from your nearest DSE store. So warm up your vocal chords and pop down for a look at the Ensing Karaoke system — it might be just what you need to liven up those dull Saturday nights. (R.E) ■

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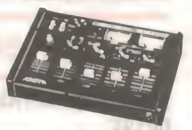

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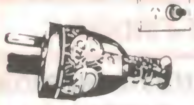

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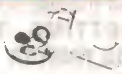

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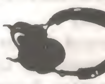

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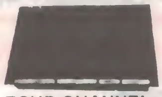

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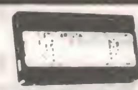

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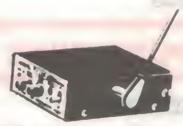

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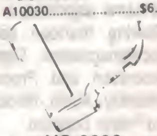

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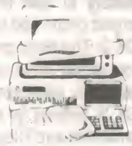

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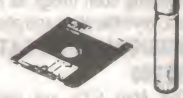

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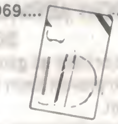

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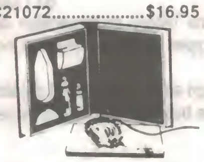
C21071................$9.95

MOUSE KIT

Everything you need to keep your mouse happy! You get a mouse pad, a mouse holder, a cleaning kit (previously described) and a cute little mouse cover.
C21072..................$16.95



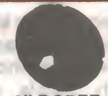
MOUSE GIFT SET

Here it is! The ultimate mouse kit. You get the cute little mouse cover to protect it from dust, the mouse cleaning kit with the rounded tool & 5 cloths, the mouse house and mouse pad all in a handy black case.
C21074..................$19.95

COMPUTER CLEANING KIT

To gain optimum performance and prevent damage to valuable disks, this cleaning kit has all you need to keep your computer in top notch performance. Anti-static cleaning pads, cleaning swabs, cleaning solution, 5 1/4" & 3 1/2" cleaning diskettes.
C21077..................$19.95

SPEAKERS

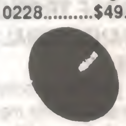


8" DOPED PAPER CONE

• High compliance rubber surround.
• 45 watts RMS
• Dark grey cone
• Black dust cap
• Black round frame
C10233..........$44.95

10" HIGH POWER WOOFER

• With ribbed black paper cone. • 40 watts
• Black dust cap
• Cloth edge
• Rubber mounting seal
C10228..........$49.95

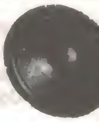


10" DOPED PAPER CONE

• High compliance rubber surround.
• 60 watts RMS
• Dark grey cone
• Black dust cap
• Black round frame
C10238..........$59.95

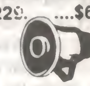
8" FULLRANGE

• Twin cone speaker with white paper cone ideal for public address column speakers.
• 30 watts RMS
• Foam edge
• Whizzer cone
C10224..........$24.95



12" HIGH POWER WOOFER

• With ribbed black paper cone • 50 watts
• Black dust cap
• Cloth edge
• Rubber mounting seal
C10229..........$64.95



6" HORN & LINE X'FORMER

• Weatherproof plastic horn with 100 volt line transformer
• 15 watts RMS
• Adjustable metal bracket
C10218...........$74.95

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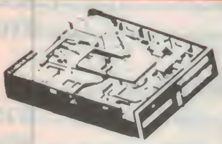
computer accessories

ROD IRVING ELECTRONICS

FLOPPY DISK DRIVE SPECIALS!



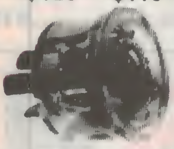
JAPANESE DRIVE SPECIALS

1.44MB 3 1/2"

1-9 $105 | 10+ $99

1.2MB 5 1/4"

1-9 $129 | 10+ $119



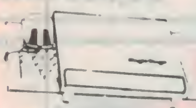
THE BUTTON SPIKE PROTECTOR

Surges and spikes are caused not only by lightning strikes and load switching but also by other equipment being switched on and off such as fluorescent lights, electric motors, fridge freezers, air conditioners etc.

For effective protection such spikes must be stopped before they reach your equipment. Simply plug The Button into an outlet and it will protect all equipment plugged into adjacent outlets on the same branch circuit. The Button employs unique metal oxide varistor technology and will dissipate 150 joules of electrical energy (nearly twice that of comparable surge arresters).

SPECIFICATIONS
Voltage: 240V Nominal
Total Energy Rating: 150 joules
Response Time: 10ns
Protection Level: 350V peak

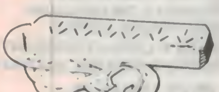
$42.95



MAGIC STAGE

A working bench for your Mouse.
- High quality ABS plastic and anti-static rubberised top
- Stationary holder
- Includes pull-out shelf for Mouse
- Dimensions: 280 x 260 x 25mm
- Fits over keyboard

C21080 On special was $24.95
Now.......$14.95

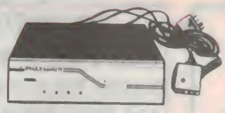


SURGE BUSTER

6 PROTECTED POWER OUTLETS
Ideal for protecting personal computers, video equipment, colour TVs, amplifiers, tuners, graphic equalisers, CD players etc

SPECIFICATIONS:
- Electrical rating: 240V AC, 50Hz, 10A
- 3 x Metal Oxide Varistors (MOV)
- Maximum clamping Voltage each MOV: 710 volts at 50 amps
- Response time: Less than 25 Nanoseconds.

X10086.....................$69.95

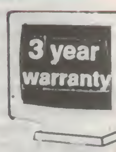


PHAX SWITCH

Lets you connect a normal telephone handset and a fax to the same telephone line.
- Detects whether an incoming call is for the phone or fax and automatically puts it through to the correct unit.
- It automatically switches when you pick up the phone or use the fax to make an outgoing call.

SAVE $20 this Month!
X19090.............$269

RITRON MONITOR

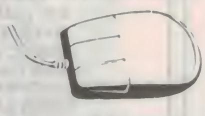


SUPA VGA COLOUR MONITOR

3 YEAR WARRANTY

This stylish & reliable monitor has been designed for Australian conditions & comes with a 3 year warranty.
Specs:
CTR: 14" 90° deflection, dark-tint, non-glare.
Display Size: 245+/5mm x 180+/-5mm
Resolution: (max): 1024 x 768
Dot Pitch: 0.28"
X14532................$489

WHAT'S NEW?



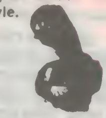
TECMOUSE

Microsoft serial & PC mouse compatible (serail Version)
- Stylish & ergonomic design gives a unique feeling of pleasure & comfort in your hands.
- Feature touch button control
- Stream-lined design, glossy finish
- Smooth well-balanced gliding

AN AMAZING $29.95

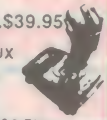
QuickShot joysticks

Quick Shot offers the most complete selection of video game controllers in the market. Models are available to suit all the most popular video game machines and just about any playing style.




QS-123 PC IBM PACK INCLUDING JOYSTICK ADAPTOR CARD (15 PIN)
C14217..........$74.95

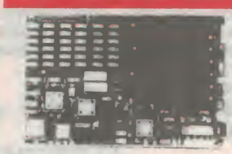
QS-129N F SPACEAGE CONTROL NINTENDO & MULTISYSTEM COMPATIBLE (7 OR 9 PIN)
C14214..........$39.95



QS-130N F DELUX DIGITAL NINTENDO & MULTISYSTEM COMPATIBLE (7 &9 PIN)
C14209..........$39.95

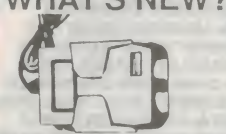
QS-131 NEW BASIC ATARI / COMMODORE -9 PIN
C14218..........$19.95

MOTHERBOARDS



286-12/16	$159
286-16/21	$199
386SX-10/20	$350
386SX-20/27	$375
386-33 WITH 64K CACHE	$750
386-33 WITH 128K CACHE	$895
386- 40	$795
486SX -20	$1195

WHAT'S NEW?



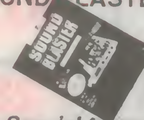
MOUSE HOLDER

Handy mouse holder attaches to the side of the computer or monitor for storing a mouse when not in use. It is supplied with adhesive velcro so the mouse holder can be easily removed from the computer or monitor if required. Will accept a mouse with maximum dimensions of 65mm wide & 35mm thick

C21064..............$3.95

SOUND BLASTERS

SOUND BLASTER II



Special Offer: FREE SPACE QUEST 1 with every Sound Blaster II.

The All-in-One sound card.

Sound blaster II is the ultimate sound board that easily plugs into any internal slot in your IBM*, PC, XT, AT, 386, PS/2(25/30) & compatibles.
FEATURES:
- Text to Speech synthesizer
- 11 vioce FM Music
- Digitized Voice Input & Output. • Midi interface
- Built-in joystick port
- Power amplifier & Volume Control
- Bundled software: SBTALKER with Dr SBAITSO VOXKIT -Voice development tools Talking Parrot FM Intelligent organ

Only................$269

SOUNDS BLASTER PRO

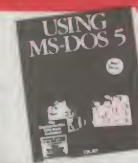
- 16 Bit card
- Stereo DAC with hardware ADPCM
- Stereo Recording for line-in and CD-Audio
- Stereo 22 voice FM music Synthesizer
- MIDI interface

CD-ROM Interface built-in
- Text to Speech Driver.
- Secectable IRQ and DMA
- Power amplifier built-in

Bundled Software:
MIDI Adaptor & sequencer
FM Intelligent organ
VEDIT: Voice editor & Utilites
CD Music player
MMPlay Presentation

Only..................$469

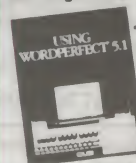
BOOKS



USING MS-DOS 5

The most helpful DOS book available has now been updated for DOS 5 so you can achieve DOS success in easy steps. Real world analogies and examples guide you to confidently write batch files and Macros. Includes a DOS survival guide giving trouble-shooting advice.

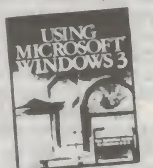
...$51.00



USING WORDPERFECT 5.1 2nd EDITION .

Discover the secrets to success for over 100 000 users! This classic best seller expertly leads you from basic techniques to advanced Word Perfect operations, with detailed coverage of all new features.

.......................$57.95

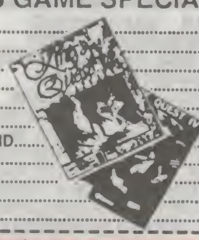


USING MICROSOFT WINDOWS 3

Advance to power user status with hands-on exercises for learning Windows basics. Then customize your system using usful tips. This handy reference also teaches you Windows Paint & Windows Write.

.......................$51.95

THIS MONTHS GAME SPECIALS



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ELVIRA	$69.95
JET SET PACK	$59.95
KING'S QUEST V	$69.95
SECRET OF MONKEY ISLAND	$59.95
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TEST DRIVE II	$69.95
SPACE QUEST IV	$69.95

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SYDNEY: 74 Paramatta Rd. Stanmore. N.S.W. Ph: (02) 5193134
MAIL ORDER: 56 Renver Rd, Clayton Vic, 3168.
Ph: (03) 543 7877
Mail Order Hotline: Ph: 008 33 5757.
All sales tax exempt orders & wholesale inquires to:RITRONICS WHOLESALE, 56 Renver Rd, Clayton, 3168.
Ph. (03) 543 2166. (3 lines) Fax: (03) 543 2648.
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P.O BOX 620, CLAYTON, VICTORIA, 3168.
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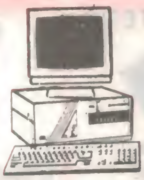
RITRON QUALITY RITRON POWER

RITRON 286-16

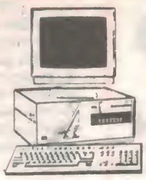


80286-12 CPU
1 MEG RAM EXPANDABLE TO 4 MEG
16Mhz LANDMARK SPEED TEST
1.2M JAPANESE BRAND F.D.D
42M HARD DISK DRIVE 28ms ACCESS
101 EXTENDED "CLICK" KEYBOARD
JAPANESE KEYBOARD SWITCHES
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 res)
SERIAL, PARALLEL, GAME PORT
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
256K VGA CARD. IBM* COMPATIBLE
SPREADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED.

ASSEMBLED & TESTED IN AUSTRALIA

$1,239 TAX INC.
$1,090 TAX EX

RITRON 286-21



80286-16 CPU
1 MEG RAM EXPANDABLE TO 4 MEG
21Mhz LANDMARK SPEED TEST
1.2M JAPANESE BRAND F.D.D
42M HARD DISK DRIVE 28ms ACCESS
101 EXTENDED "CLICK" KEYBOARD
JAPANESE KEYBOARD SWITCHES
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Res)
2 SERIAL, PARALLEL, GAME PORTS
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
256K VGA CARD. IBM* COMPATIBLE
SPREADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED.

ASSEMBLED & TESTED IN AUSTRALIA

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$1,120 TAX EX.

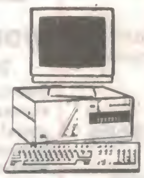
OPTIONAL EXTRAS

ADD PRICE TO BASE SYSTEM COST.
512K VGA CARD......................$50
1M VGA CARD.......................$100
TO CHANGE A
40M HARD DRIVE TO A
85M HD add $150
126M HD add.......................$290
200m HD add.......................$700
EXTRA RAM
1 MEG add..........................$80
2 MEG add.........................$160

PLEASE NOTE SYSTEMS DO NOT COME WITH DOS.

DOS 4.01 AN EXTRA..............$60
DOS 5.00 AN EXTRA..............$100

RITRON 386SX-27



80386SX-20 CPU
1 MEG RAM EXP TO 4 MEG
27Mhz LANDMARK SPEED TEST
1.2M JAPANESE F.F.D. 512K VGA CARD
43M HARD DISK DRIVE, 18ms ACCESS
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR (1024 x 768 Resolution)
SERIAL PARALLEL GAMES PORTS
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
IBM* COMPATIBLE
SPREADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED.
• SHAREWARE SOFTWARE

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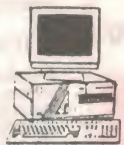
RITRON EXECUTIVE 386-57



80386-33 CPU 64K CACHE ON BOARD MEMORY
1 MEG RAM EXP TO 16 MEG
57Mhz LANDMARK SPEED TEST
43 MEG HARD DISK 18ms ACCESS TIME
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL PARALLEL GAMES PORTS
SUPA VGA COLOUR MONITOR (1024 x 768 Resolution)
MINI CASE & 200W POWER SUPPLY
512K VGA CARD (256 COLOURS) IBM* COMPATIBLE
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED.
*SHAREWARE SOFTWARE

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$1,650 TAX EX

RITRON EXECUTIVE 386-75

80386-40 CPU 64K CACHE ON BOARD MEMORY
1 MEG RAM EXP TO 16 MEG
650Mhz LANDMARK SPEED TEST
126 MEG HARD DISK 12ms ACCESS TIME
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS 512K VGA CARD
SUPA VGA COLOUR MONITOR (1024 x 768 Resolution)
MINI CASE & 200W POWER SUPPLY
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED. *SHAREWARE SOFTWARE

ASSEMBLED & TESTED IN AUSTRALIA.

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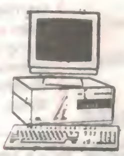
$1,975 TAX EX.

WITH 200 MEG DRIVE
$3,195 TAX INC.
$2,685 TAX EX.

RITRON EXECUTIVE 486-75



80486SX-20 CPU 64K CACHE ON BOARD MEMORY
1 MEG RAM EXP TO 32 MEG
75Mhz LANDMARK SPEED TEST
43 MEG HARD DISK 18ms ACCESS TIME
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS, 1MEG VGA CARD
SUPA VGA COLOUR MONITOR (1024 x 768 Resolution)
MINI CASE & 200W POWER SUPPLY
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
SPEADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED. *SHAREWARE SOFTWARE

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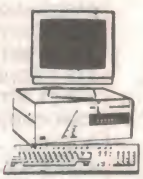
$2,035 TAX EX.

WITH 200 MEG DRIVE
$3,295 TAX INC.
$2,850 TAX EX.

RITRON EXECUTIVE 486-115



80486-33 CPU
ON BOARD CACHE. 1 MEG OF RAM
115Mhz LANDMARK SPEED TEST
85 MEG HARD DISK 12ms ACCESS TIME
1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
VGA COLOUR MONITOR (1024 x 768 Resolution)
MINI CASE & 200W POWER SUPPLY
3 YEAR "AUSTRALIAN" PARTS & LABOUR WARRANTY
SPREADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

$2,895 TAX INC.
$2,495 TAX EX.

WITH 200 MEG DRIVE
$3,595 TAX INC
$3,055 TAX EX

RITRON EXECUTIVE 486-157

80486-33 CPU ON BOARD CACHE. 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 12ms ACCESS TIME
1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
VGA COLOUR MONITOR (1024 x 768 Resolution)
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SPEADSHEET, WORDPRCESSOR & DATABASE SOFTWARE.

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IDEAL CAD MACHINE!

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$500 PLUS...FREE

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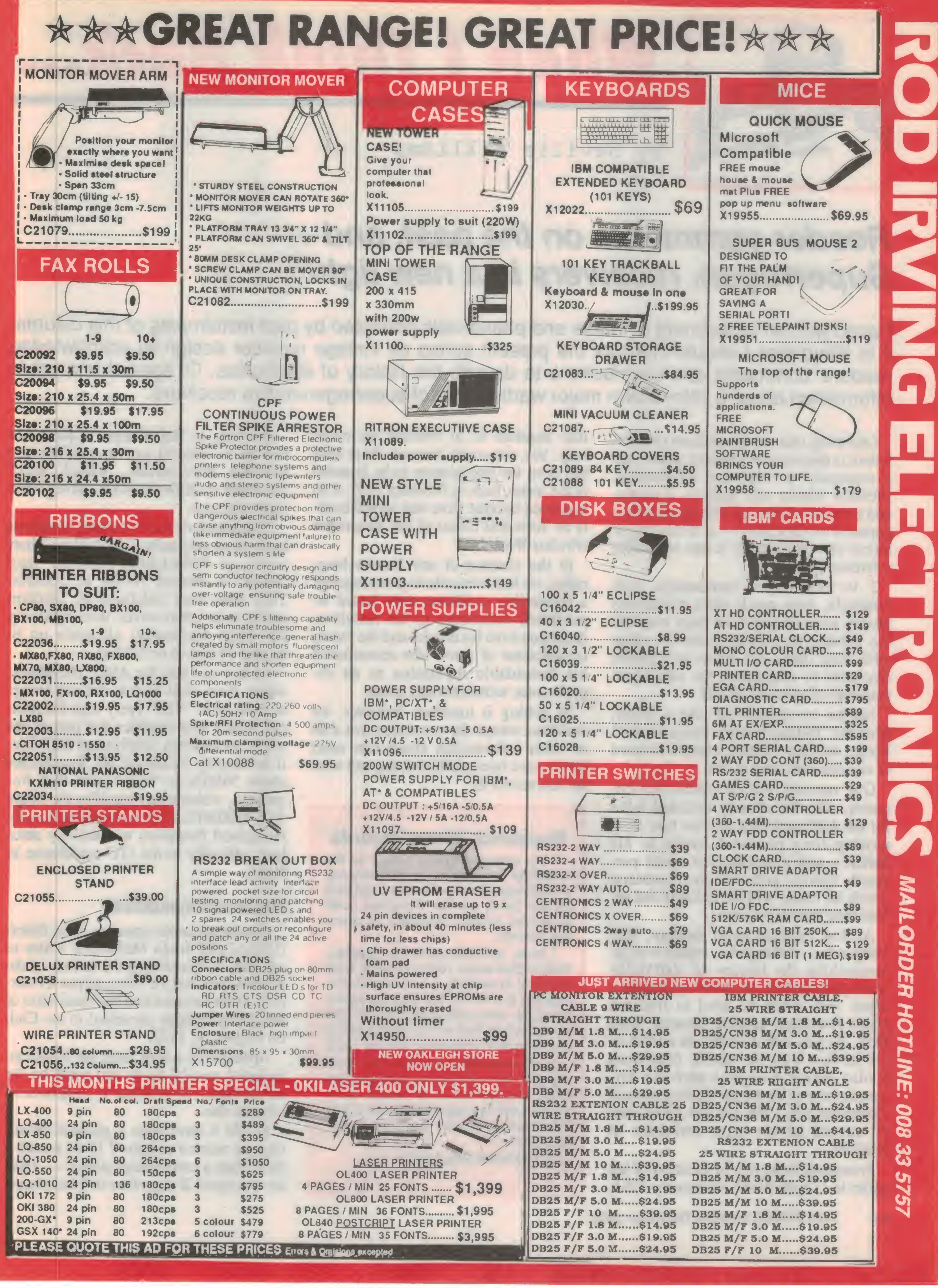
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When I Think Back...

by Neville Williams

Reader comments on the past, and Superregen. receivers in a new light

Faced with an assortment of letters and phone calls prompted by past instalments of this column, it is fitting that I should interrupt the present series on vintage receiver design to acknowledge readers' comments and contributions to do with the history of electronics. Of special interest is information about a little-known major wartime role of superregenerative receivers.

One thing that stands out from readers' letters is that no one writer or source has a monopoly on historical information. Mention almost any subject, it seems, and someone comes up with spontaneous personal recollections — or a clipping or article that didn't make it into accessible reference files.

It is saddening to contemplate, with hindsight, how much other electronics history must already have been lost with the passing of industry pioneers, along with their dusty old books and papers discarded by relatives in the subsequent dispersal of personal effects.

Maybe we should all take a lesson from the 'Talking History' series on ABC Radio, and leave behind a tangible record of our one-time way of life.

One recently retired electronics engineer, who has already recorded tapes for the ABC archives, told me how he is writing long personal letters to his children and grandchildren about personal, family and technical matters, which he hopes will be retained and reread long after he is gone.

A New Zealand radio amateur, Bob Cooper Jnr. of Mangonui, relates how, in researching the history of VHF/UHF wave propagation, he came up against a blank wall when he tried to find out about Australian pioneer amateur Ross Hull. He was able to obtain an outline of his service with the ARRL (American Radio Relay League) and the circumstances of his tragic electrocution in Connecticut in 1938, but the ARRL had no record of his prior activities in Australia.

Prompted, however, by mention of his name in 'Think Back' for January 1991, Bob inquired as to whether we could help. Yes, we could, because Ross Hull had been the first pioneer to be featured in the series, back in February 1989. It so happened because Ross had served briefly as Technical Editor of our forerunner *Wireless Weekly*.

In the absence of any known biography, we had been able to piece together a reasonably cohesive story based on published references to his activities, deduction from his articles and the fading recollections of some who remembered his formidable reputation as an experimenter, technician and writer.

In getting it together, however, we could not escape the conviction that a lot of other information about him must surely have been published, beyond what we had access to.

Brunswick 78rpm Records

I am researching the history of the American Brunswick Record Company in Australia. No local artists appeared on the label, as the Company used American master stampers to press the records.

I have a small collection (approx. 300) of Brunswick 78rpm records, from classical to comedy. I am interested in locating the site of the Sydney pressing plant, and a description of the type of equipment that would have been in use for record production around 1924.

I was wondering whether you could suggest any suitable magazine/papers from the period that would have profiled the Company in Australia. Any information would be greatly appreciated.

J.D. (Neutral Bay, NSW)

Relevant to Bob Cooper's quest, we had to be careful not to confuse the various wavebands, which were described in different ways during Ross Hull's lifetime.

Transmissions in the present broadcast band were originally classified as 'short wave', as distinct from those on 'long waves' — around 1000m or 300kHz. They were later redefined as 'medium waves' with 'short waves' then signifying HF (high frequency) channels up to around 10 metres or 30MHz.

As late as 1936 the *ARRL Handbook*, which Ross Hull edited, did not recognise the term 'VHF' (very high frequency), which now signifies that part of the spectrum between 30MHz and 300MHz. It arbitrarily classified all frequencies above 50MHz as 'UHF' (ultra high frequency), which today signifies the range 300- 3000MHz. (The now internationally recognised frequency terminology dates back officially to the ITU conference in 1959).

Historic broadcast

Another amateur operator, Alan Elliott (VK3AL) of South Melbourne writes to say that, in researching the history of the Melbourne Club, he came across a reference in the minutes to a demonstration of wireless telephony presented to the Club on August 16, 1923.

Arranged by a Mr Cutler, the broadcast included musical items and a talk on the advantages of joining a progressive camera club.

Would it have been a genuine broadcast, he wanted to know? If so, would it have been a commercial station — 3AW for example? If not, when did that station

commence broadcasting? Who was the Mr Cutler referred to in the minutes?

In an effort to help, we contacted S.M. (Syd) Newman, a long retired AWA Melbourne identity featured in our January 1991 issue. Syd had no recollection of the broadcast, having been on assignment in Britain during 1923.

He confirmed, however, that AWA had a small transmitter in Melbourne which could have been used for a demonstration broadcast. The broadcast could alternatively have originated from the coastal radio station VIM, under the callsign 3ME.

Syd remembered Cliff Cutler as a general engineer attached to the Australian navy when it operated the coastal radio service. When AWA took over the service, Cliff Cutler transferred to the AWA Melbourne staff.

3AW could not have existed in 1923, he said, but came into being much later (the actual year was 1931).

There the trail ended, but Allan Elliott had learned enough to reason that the broadcast in question would probably have been the first in Melbourne, and perhaps in Australia, to promote a camera club — of which he is a member.

Unfortunately, there was no point in encouraging him to inquire further from AWA. I gather that, in the current scramble for productivity and minimal overheads, one-time institutional indulgences like a captive historian have disappeared, along with a generation of AWA-bred executives with memories stretching back to that era.

Announcer's licence?

3AW features in another letter, this time from an officer of the Salvation Army in Fremantle, WA. He says that the Administrator of an Army WA senior citizens centre, Mr Jim McBride, was due to retire and they were keen to gain access to memorabilia of his earlier life, for the farewell function.

It seems that Jim McBride was involved in outside broadcasts for 3AW, about 35 years ago, in the time of Sir Eric Pearce. I could only explain that, unless involved in networking, program personalities were unlikely to be known or featured in the media outside their own city. The information he was seeking would have to be obtained direct from 3AW or Melbourne-based publications.

3AW could only apologise for their inability to assist, on the grounds that their archives had been lost. As for 35-year-old newspaper and magazine files, a systematic search is difficult enough if one is on the spot, with ample spare time. For a visitor from thousands of kilometres away, it could be a near-hopeless task. All the best for your retirement anyway, Jim!

Good wishes aside, there was one reference in the letter that caught my attention. I quote:

From information gleaned from Jim, it appears that he was involved with outside broadcasts when announcers were required to hold specific rating certificates authorising 'ad libbing' or pre-prepared announcing.

What gives? I've lived through the era of radio broadcasting, I've read about it and written about it, but I've never heard mention of radio announcers having to hold any kind of licence. Nor have any of my friends to whom I've mentioned the matter.

We've all simply assumed that people got to be announcers if their employer considered that they had an acceptable voice and presentation, an appropriate background and so on, and were in the right place at the right time when an appointment had to be made.

Was Jim McBride referring to an inhouse certicate used by 3AW — and possibly by other stations — to facilitate program planning and rosters? Or was it an accreditation required by the authority administering radio broadcasting at the time?

If the latter, then it's a spot of history that I (and others) seem to have missed out on. Some reader should be able to set the record straight.

Brunswick records

Speaking of records, I wonder whether the name 'Brunswick' stirs any memories. For me, it served as a reminder of a stack of surplus 78rpm discs which I gave away years ago, when I had to make room for the new LPs. Who, having once heard the sound quality from a microgroove record, could possibly want to listen to the old coarse-groove shellacs?

The answer: people who treasured the musical heritage they contained, and who have since provided the raw material from which engineer/musician Robert Parker has reconstituted his amazing new recordings. Using state-of-the-art techniques, he has been able to discard the clicks and plops which marred the old pressings and to restore something akin to the original balance and dynamic range.

And again, there are people like Jim Dangarfield, whose letter is summarised in the accompanying panel. Music lover or not, Jim is obviously a vintage enthusiast who treasures his unique collection of Brunswick 78's, and who wants to know more about their sourcing in Australia.

In other days, I would have been able to pick up the phone and raise the matter with EMI's chief recording engineer R.V. (Reg) Southey, or with two or three other pioneers, still working in the industry; men who had refined their skills in the 78 era. But that generation has long since disappeared from the everyday scene, to be replaced by younger engineers who know the 78 era only by repute. Indeed, the analog record industry itself is being ushered out by competition from tape and the digital compact disc.

According to EMI's one-time company publication *The Voice* (August 1954), Reg Southey had been responsible for setting up Australia's first recording studio in Sydney's Homebush, in 1926 — coincident with the adoption of electrical recording. As to prior activities in the way of disc processing, it is silent.

I've read about old-time disc processing, and discussed it verbally and in print, but failed completely to find the kind of reference material that Jim Dangarfield is looking for. It is most likely to be found, I would think, in science/technical books and magazines from the early 1920's, and/or in early copies of the English *Gramophone* magazine, which began publication in 1926.

The book *From Tin Foil to Stereo* by Read and Welsh (Howard W. Sams Inc., New York, 1976) includes brief mention of the Brunswick Company, with particular reference to the era when the American record industry was dominated by local 'pop' music and heavily dependent on trans-Atlantic imports for more substantive material.

On that basis, a fair proportion of the more collectable Australian Brunswicks may well have originated in British recording centres.

The authors of the book have assembled a quite fascinating history of the phonograph, mainly from the American viewpoint, but the technology of processing discs is not covered.

Hopefully, someone reading this column will know whether Brunswick had their own disc production facility in Australia, or whether they were contracted out to another company. And/or you may know of an accessible article which describes the pressing process, as it was in the 1920's. If so, please contact me through the Editor, and we will pass the information on.

In the meantime, Jim Dangarfield may care to get in touch with the Powerhouse Museum in Sydney, and the National Film & Sound Archive in Canberra. They may well be able to help.

Kiwi picture show

Before taking up the major theme of this instalment, I must acknowledge three other letters.

E.G. (Ted) Baker from Bathurst, NSW says he was intrigued by the story in the Feb/March 1991 issues, of a country picture show. It came as an uncanny reminder of one he remembered as a boy in Otautau, New Zealand.

It too was set up in a community hall, and in the days when they had only one projector, there was similar uproar when the show was interrupted to change reels. Ted Baker won the coveted job of assisting the operator for one shilling per week, which meant that he saw the pictures for nothing!

Like the show in my story, it was ultimately equipped with two converted silent projectors and an 8-watt amplifier, using push-pull 2A5's. For the arc supply, they used a DC generator which was belt driven from a temperamental model-T Ford engine.

Ted's first task each Saturday evening was to start the engine — with his thumb in front of the handle as a precaution against a back-fire. Even then, he had to snatch his arm away, lest the crank do a full reverse spin and smash into the back of his hand.

Up in the box, his job was to adjust the arcs and the sound level, hopefully without getting so absorbed in the picture that he forgot what he was supposed to be doing! Thanks for your letter, Ted.

Spark transmitters

From Pascoe Vale South in Victoria, Rod Torrington (VK3TJ) takes up a different theme — that of spark transmitters. As recently as April 1939, he says, he was radio operator on the *Tanda*, plying between Melbourne/Sydney and Hong Kong/Shanghai/Japan. The main transmitter was a 1.5kW Marconi-C spark type, with a smaller 250W spark unit as a standby.

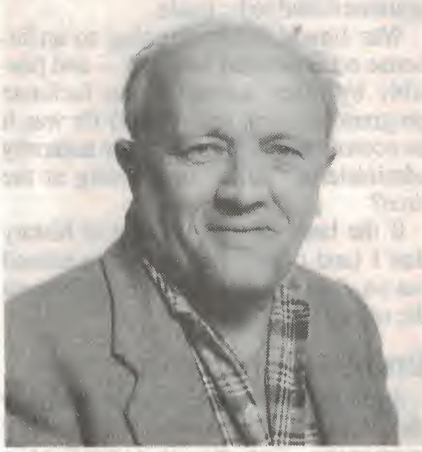
Operating from a rotary converter powered by the ship's DC supply, the main transmitter drew about 20 amps of primary current. During a long message, he says, the bug-key would become almost too hot to touch.

The main transmitter was housed in what looked like a butcher's cool room, with 6" thick walls and double doors — intended to suppress the noise of the spark, estimated to be at least 110dB. Changing frequency from 'call' (500kHz/600m) to 'traffic' (705m) involved leaping out of the chair, opening the doors into the 'cool room' to change the inductor tapping, closing the doors and getting back to the operating position.

One of the lurks, when passengers begged to see the radio gear, was to invite them to watch the transmitter in action with the doors open!

After the *Tanda*, Rod worked for a while on the *Bidelia* (John Burke line, ex-Sydney), which was equipped with an AWA spark transmitter and a Bellini Tosa direction finding receiver. Rod's contact with spark gear ended about then, when he joined the Marine and Aviation departments of AWA (Ashfield, NSW) and later DCA. As such, he regards himself as an AWA old-timer.

Thanks for your letter, Rod, and I'm glad that we were able to stir a few memories — even though it involved a technology with which I, personally, had no contact.



Don Sutherland, ZL2AJL, to whom I am indebted for the further information on superregenerative receivers. Don says that he has assembled a considerable dossier on the subject.

Blunder explained...

An apparent error in one of my earlier articles (May 1990, p.37) concerned a reference to Lee de Forest as 'by then Professor of Physics at Cambridge University'. This was challenged by New Zealand author John W. Stokes, who maintained that my source, the *Australasian Wireless Review* of October 1923 "must have got its wires crossed". I admitted some puzzlement at the time, but assumed that, as a well known American pioneer/academic, de Forest may have been at Cambridge in a visiting role.

More recently, I was thumbing through the old *AWR*'s for an entirely different reason, when I came across the preceding September 1923 issue — featuring a cover picture of Sir Joseph J. Thompson. Underneath, in small type, was the caption 'Professor of Physics, Cambridge University, England. The discoverer of the electron'.

Suddenly intrigued, I flipped over to the cover of the October issue. And what had happened was plain for all to see...

In preparing the October issue, the layout artist had obviously taken the basic cover artwork, stripped off the portrait of J.J. Thompson and replaced it with that of Lee de Forest.

He/she had also substituted the new heading and dateline, but had overlooked the small-type caption. So it was that Lee de Forest went to print as 'Professor of Physics, Cambridge University...' etc. Sorry about that, but such things can happen all too easily.

I remember that the March 1979 issue of this magazine, for example, was all printed, bound and ready for despatch when someone noticed that its front cover carried the date 'March 1978'. A hastily-assembled team spent a whole weekend in the printery, obliterating the 1978 figure on something like 50,000 separate copies with a coin-sized adhesive label marked 1979! You may well have the issue amongst your own back-numbers...

Superregen detectors

In the second part of an article on Edwin Armstrong, in the August 1990 issue, I mentioned his invention of the superregenerative detector (1922) and the longstanding uncertainty as to how it really worked. It caused me to speculate privately how well Armstrong himself understood the circuit, and whether he had devised it by analytical or empirical means.

Fortunately, having gained access to an American IRE paper by Hikosaburo Ataka (August 1935) by courtesy of Alan M. Fowler of Balwyn, Victoria, I was able to extract what may arguably have been the first explicit word picture of its operation to appear in a popular level electronics magazine. (*EA*, May 1991).

Re-stated very briefly, a superregen detector produces pulses or 'packets' of oscillation at the intended signal frequency, the pulse repetition rate being determined by a separate, cyclic and (normally) supersonic 'quench' signal.

Importantly, the oscillatory pulses do not commence spontaneously at precise intervals, nor are they uniform in terms of duration and energy content; neither are the resultant excursions of the detector's average anode current.

Individual pulses, rather, are triggered by 'noise' or extraneous signal components, which happen to be present around the time that the detector is being enabled or cycled into oscillatory mode by the quench voltage.

In consequence, the duration of the pulses of RF oscillation and of mean anode current are a resultant of what are effectively 'samples' of the noise/signal input.

When the circuit is optimally adjusted, the variations in mean anode current are very large compared with the miniscule 'trigger' samples; hence the extremely high detector gain.

In the absence of any external signal, the detector is triggered by its own 'shot' noise, creating the loud rushing sound that characterises a superregen detector under no-signal conditions. With a coherent signal present, triggering becomes more a function of the audio modulation and the noise component is progressively overridden.

Dossier on Armstrong

Subsequent to the publication of the May 1991 article, I was contacted by a New Zealand amateur operator D.C. (Don) Sutherland (ZL2AJL), who indicated that he had assembled quite a dossier on Armstrong and his superregenerative receiver.

It includes Ataka's paper but, as well, Armstrong's original presentation to the American IRE in June, 1922; another by F.R.W. Stratford, in 1945; and a 169-page book in the *Modern Radio Technique* series edited by J.A. Ratcliffe. Said to be the only known book on the subject, it is titled *Super-Regenerative Receivers* by J.R. Whitehead (Cambridge University Press, 1950).

Don Sutherland, by the way, was born in 1925 and was first enthused about wireless at age 11, when he read an article on the subject in Pears' Cyclopaedia. His interest was heightened about the same time when a family friend presented him with a miscellany of books, bits and pieces and a Philips A409 valve — which, he says, resulted in something of a 'soft spot' for the marque. Then followed a couple of RCA tube manuals, which created an awareness of valve curves and characteristics.

Afer secondary school, he got a job in a radio service shop in New Plymouth, where he got to work on a wide range of imported and NZ-produced radio receivers until returning to the family farm in 1945. But his heart was in radio, and he qualified for his amateur 'ticket' in 1945.

Obviously a lateral thinker, Don says he used to mentally digest technical papers and dream up circuit ideas while feeding the pigs. When faced with solid-state theory, he was bugged by the tendency of writers to contrast valves and transistors.

He reasoned that it should be possible to define areas of behaviour where they overlap. This I have passed on to Jim Rowe for possible use in 'Forum', but in the meantime, I am grateful to Don for his very considerable assistance in the matter of superregen detectors.

Original 1922 paper

Turning to Armstrong's original paper, it becomes immediately evident that he understood very well what he was grappling with. Significantly, perhaps, he acknowledged the assistance of Professor L.A. Hazeltine on the theoretical side, as well as practical assistance from a Mr W.T. Russell.

At the outset, the paper discusses the positive and negative tuned circuit resistance concept in regenerative systems, and explains the effect of changing the ratio between the two. Armstrong points out that excess negative resistance promotes free oscillation, which 'paralyses' the ability of the circuit to sense external signals.

In reading this preamble, it became evident where the explanation came from that I paraphrased on page 33 of the August 1990 issue. But while arguably correct, it leaves the reader no wiser!

Armstrong's paper reveals, however, that Turner in Britain had earlier patented the idea of modifying the natural behaviour of a regenerative system by the application of critical negative bias to the grid, and using a mechanical relay to periodically shunt and disable the feedback coil.

Another British inventor, Bolitho, had replaced Turner's relay with a valve paralleling the oscillator, but imposing degenerative feedback and operated from an AC supply. As such, it periodically suppressed the original oscillations.

Armstrong managed to translate these rudimentary ideas into more practical circuitry which he was duly able to patent. In the process, however, according to Don Sutherland, Armstrong took the precaution of buying the rights to both of the earlier British patents. When he ultimately offered the system to RCA, there was no way they could capitalise on such prior publication.

As reported in the August 1990 issue, he was able to negotiate for $200,000 in cash and 60,000 RCA shares — money which was to be dissipated by the ongoing litigation which seemed to be the story of Armstrong's life.

Armstrong's research

Having outlined these prior suggestions, Armstrong's paper explores various methods of manipulating the negative and positive resistance of regenerative configurations by superimposing voltages from separate valves, fed with a recurrent signal.

It makes somewhat tedious reading, requiring frequent reference to diagrams. In the process, I could not escape the feeling that Armstrong was rather too close to his subject and in a mindset more appropriate to compiling a patents document. He tends to separate the functions of the regenerative stage, the quench oscillator — a term that I did not find in the paper — and detection, or the means by which the message is recovered; this last because he had to consider both telephony and telegraphy, in the latter case involving both modulated and unmodulated spark/arc transmissions.

This leads into extensions of the superregenerative approach, by the possible use of signal frequency doubling or superhet frequency changing, to help stabilise cascaded superregenerative stages.

Back to the original theme, however, Armstrong claims that signals which might typically produce only the faintest heterodyne in a conventional regenerative receiver have been shown to produce clearly understandable speech on an uncomplicated superregenerative receiver.

The formal summary of the paper reads (in part):

A system of circuits is described whereby the effective resistance of a regenerative circuit is periodically made positive and negative, though predominantly positive. Such a circuit will respond to an impressed electromotive force by setting up free oscillations during the negative resistance period, which oscillations are proportional to the exciting emf...

There, in Armstrong's own words, lies the key to unlocking the seeming mystery of the superregen receiver, which I was at such pains to extract from elsewhere for the May 1991 issue. But overshadowed by the preceding 16 pages of circuituous discussion, it is no wonder that it was not picked up by popular level technical writers of the era, or communicated to the then generation of enthusiasts.

Having thus said, it is reasonable to suggest that Ataka's paper (IRE USA August 1935) was a response to the challenge to rationalise and quantify basic su-

perregenerative receivers, taking advantage of the intervening decade of technical sophistication and instrumentation. According to Don Sutherland, the only oscillograph available to Armstrong in 1922 had been a Duddell electromechanical string model. Ataka's paper was discussed in this column in the May 1991 issue.

Mathematical analysis

A further paper brought to my notice by Don Sutherland was one by F.R.W. Strafford of A.C. Cossor Ltd and Belling & Lee Ltd (*Journal Instn. Elec. Engrs.* 93, March-May 1946).

According to the formal introduction, the paper seeks to clarify the performance criteria of superregenerative circuits 'in practical operation', ostensibly rendered uncertain because (I quote) 'a great deal of the mathematical analysis is clothed in obscurity from the engineering viewpoint because of the inclusion of second-order effects'.

Not surprisingly, the paper itself relies heavily on mathematical analysis. But helpfully, the conclusions are spelt out for non-mathematically trained readers.

Strafford shows that, in the circuitry under consideration, the onset of squelch should be gradual rather than abrupt, the logical choice being a supersonic sinewave no higher in frequency than strictly necessary. With appropriate ratios of signal frequency to modulation bandwidth and to squelch frequency, the amplification 'can be many millions'.

He shows mathematically that the demodulated output from a superregenerative detector is substantially independent of signal carrier amplitude, ensuring a high degree of self-AGC.

On the other hand the linearity of a superregen detector is shown to be 'apalling', rendering it unsuitable for use with normal amplitude modulated program signals. For reasonable quality, program modulation would have to be limited to 60%, with reasonable speech intelligibility being preserved up to about 80%.

On the vexed question of selectivity, Strafford indicates that it is optimised when the circuit resistance becomes negative at a relatively slow rate — even as low as 8kHz. Selectivity can be at least equal to or better than that of the same basic regenerative detector, adjusted manually to the fringe of oscillation. Given an appropriate degree of selectivity, a superregenerative detector can also resolve frequency modulated signals by deliberate detuning to achieve slope detection.

Again, a superregen detector has the potential to reduce pulse-type noise interference, but much depends on the duration of the pulses and whether they happen to synchronise with the quench intervals.

So to the textbook

If at this point you feel that you're reasonably comfortable about the superregen concept, I'm sorry to have to disturb your equanimity — because that was the effect of working through J.R. Whitehead's book on the subject.

While I lacked the time or the committment to study it in exhaustive detail, it nevertheless became readily obvious that, published in 1950, it reflects a level of wartime research and development, with designs that were not available to the earlier writers.

In fact, in chapter eight of his book, Whitehead suggests that early writers like Ataka (1935) Scroggie (1936) and Frink (1938) were concerned mainly with explaining the phenomenon of superregenerative receivers as they knew them.

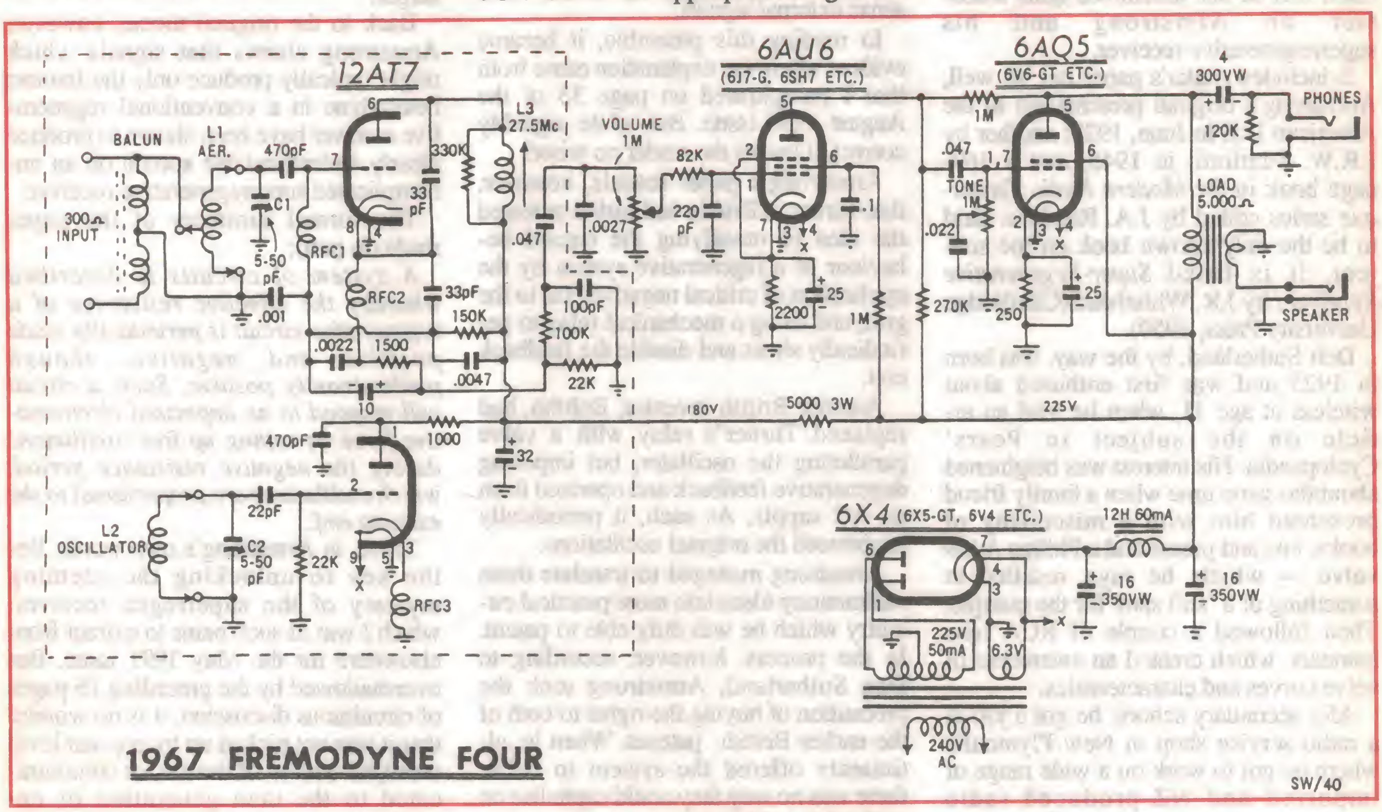


Fig.1: A 'Fremodyne' superregenerative superhet. One half of the 12AT7 operates as a self-quenched superregen detector/mixer, at a signal input frequency determined by L1C1. The other half of the same valve operates as a superhet local oscillator, tuned by L2C2 to produce resultant modulated energy pulses in the output of the detector/mixer at an intermediate frequency of 27.5MHz. Picked up by an R/C network and the modulation content passed on to the audio amplifier section.

It was during this period (1935-38) that the superregen principle was finding favour with amateur operators as the basis of inexpensive VHF/UHF receivers. In fact, during 1933-6, the US Army Signal Corps also adopted a 'walkie-talkie' using a superregen receiver, which saw limited service durind the war.

But far and away the most notable wartime use of the concept was as a receiver for the top secret 'IFF' (Identification, Friend or Foe) responders devised for military aircraft and ships. On being exposed to an incoming radar beam, the equipment would respond with a distinctive pulse which could be recognised as that of a 'friend' by a potential attacker.

The refined Mark III IFF was fitted with AGS (automatic gain stabilisation) which held its absolute gain over a 30MHz scanning bandwidth (157-187MHz) to within +/-5dB and eliminated the need for manual adjustment.

According to Whitehead, something like 200,000 such units were produced in the UK and USA and fitted to virtually every allied ship and plane. Similar responders were fitted to early radar beacons, including the Eureka paratroop beacon. Across the channel, the Germans also exploited updated superregen circuits, although to a lesser degree. The Lichtenstein air interception receiver is quoted as an example.

Such widespread use of the system provided an incentive to pursue aspects and possible applications that had remained hitherto largely unexplored, and put to rest the longstanding impression that superregen receivers were intrinsically unpredictable and unstable.

It showed that, given appropriate design and quality control, they had earned the right to be considered for specific applications, against other circuit configurations, particularly in the VHF/UHF region.

Other matters mentioned in this final chapter include superregen two-way receiver/transmitters and the use of superregenerative superhet circuits for FM or other VHF reception, including the Hazeltine 'Fremodyne'. (Fig.1 shows the circuit of a Fremodydne receiver described for home construction in the March 1967 issue of *EA*.)

In considering these more recent applications, Whitehead emphasises that there are two fundamentally different modes of superregenerative behaviour, which he describes as 'logarithmic' and 'linear' — an important distinction that may have escaped early researchers and, consequently, those who have relied on pre-war literature.

In the logarithmic mode, the free oscillation enabled by the quench voltage and triggered by noise/signal components is allowed to achieve a maximum amplitude determined by the circuit constants, before being quenched.

As illustrated in *EA* May 1991 on page 40, the packets of free oscillation all achieve the same maximum amplitude but vary in duration, depending on the exact timing of the triggering signal. Whitehead says that most pre-war literature and designs tacitly assume this mode.

Certainly, the May 1991 diagram comes from the Ataka paper, and is repeated in modified form by Strafford. According to Whitehead, the description 'logarithmic' refers to the distinctly non-linear relationship between signal modulation depth and detector output in the above situation, and is the basic reason for high distortion with heavily modulated transmissions. It also accounts for the self-AGC effect referred to earlier in the article.

The alternative mode, which was not pursued in the early stages, involves manipulating the applied voltages and quench amplitude, frequency and waveform to ensure that the build-up of free oscillation is interrupted or damped before the amplitude achieves the self-limiting level.

As a result, the burst amplitude reflects that of the relevant triggering sample. This being the case, the relationship between modulation depth and detector output becomes substantially linear, and the circuit can cope with high levels of modulation.

The linear mode called for a more deliberate design approach, and commonly, the provision of AGS (automatic gain stabilisation) to ensure that signal levels stayed within the required tolerances. By that time, Whitehead says, you have a receiver with about as many valves as you'd have been prepared to put into a superhet!

Thinking back, I seem to remember stacks of war surplus IFF responders that seemed useful for nothing except the parts. I don't recall anyone ever saying that they included a superregen receiver, even though they were serviced and possibly manufactured in Australia.

Maybe it doesn't matter any longer, but at least I know now that there was/is a lot more to a superregen receiver than a couple of valves and an off-putting hiss.

But at this point prudence, in the form of a bespectacled Editor, reminds me that I must sign off! ■

When Armstrong first developed the idea of the Superregenerative receiver in 1922, the only oscillograph available was the Duddell string type shown here. It was essentially a D'Arsonval string galvanometer with a small mirror attached to the strings; a light beam reflected by the mirror would allow plotting of a current waveform on photographic paper.

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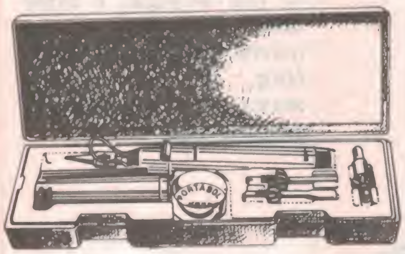

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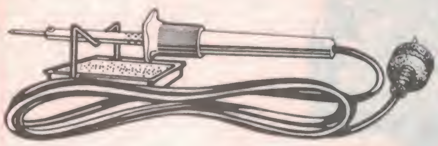

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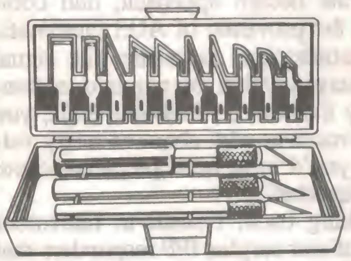

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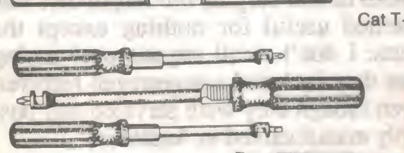

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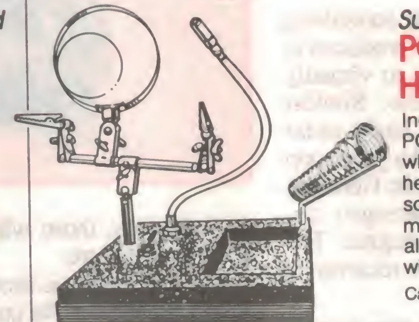

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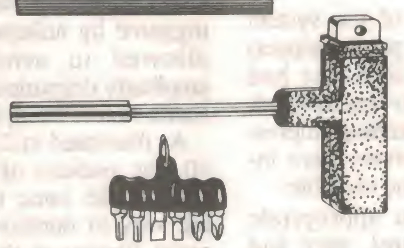

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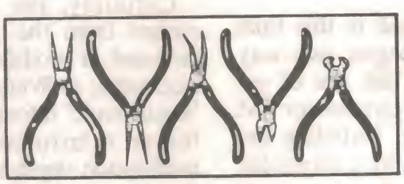

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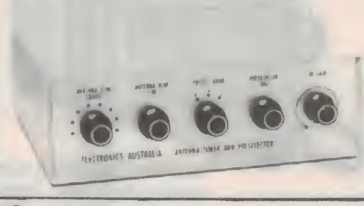

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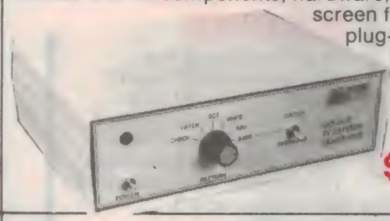

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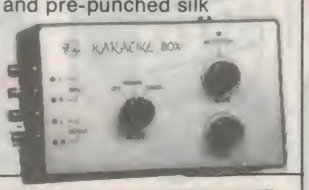

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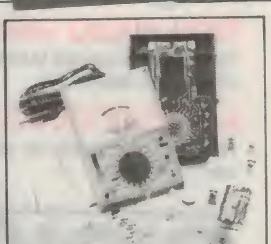

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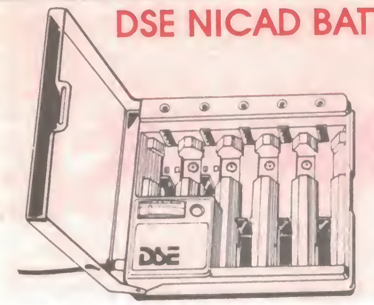

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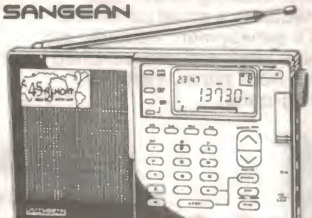

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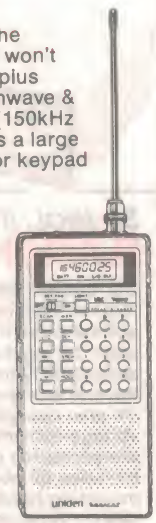

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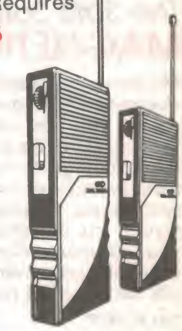

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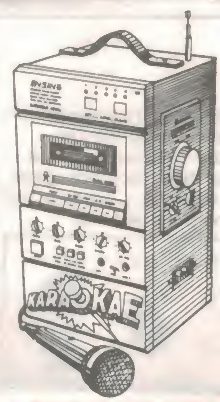

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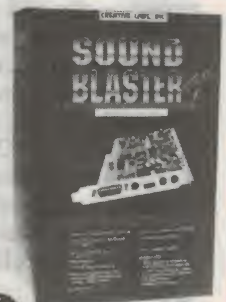

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Shake hands with the devil — 1

The hazards of electricity are widely known, but the number of people killed every year shows that the danger of electricity is underestimated. Many have been lulled into complacency before 'shaking hands' with this devil. Part 1 of this article highlights these hazards, while part 2 will examine the biological effects of electricity. The author is Physics and Chemistry Master at Morton Bay College, Brisbane.

by RICHARD WALDING

'What's black and hangs from the ceiling' might well describe an Irish electrician but in reality it's no laughing matter. My father, an electrician, used to tell me of the reckless things people would do.

When he was a maintenance electrician at English Electric, one of the travelling cranes developed a fault. The factory switchboard was housed in a large wire cage and only the electricians had the keys and authority to enter. He entered the cage to locate the fault, isolated the crane then locked the cage and went to make repairs.

On his way back, the crane started. The operator was caught poking the reset switch with a eight-foot length of conduit between the mesh of the cage. I was almost fatherless. The operator came close to dismissal — only his non-familiarity with English saved him.

At another time, one workman was instantly dismissed for merely looking inside an unlocked switchboard that the electricians were working on.

Maintenance electricians, unlike home hobbyists, can't always turn off the power to investigate problems. Downtime costs money and if it can be avoided, it is. My father said that when working on live equipment, standard practice was to stand with your free hand in your pocket or behind your back. Workmates said the electricians looked like artists.

He'd tape up the shaft of his screwdriver and hope not to cause a short circuit. Sometimes the end of the screwdriver would be blown off in a huge flash, but he never once had a tingle.

It's the harmless tingles that develops the complacency. A few years ago in *EA*, Leo Simpson described how he caught his daughter with a knife in a toaster and gave her a lecture on electrocution. "But Dad, I've already had an electric shock" she said, referring to a non-lethal electric fence. Minor shocks breed complacency.

Birds can sit safely on a 415V wire. Put one leg on the other wire and you'll grill your vital organs.

Speaking of shocks, we had a mysterious shutdown of our Apple network at school recently. The cause of the problem turned out to be a toad which had climbed into the Digicard disk drive and sacrificed itself across the stepper motor transformer. Presumably it verified Galvani's experiment with twitching frogs legs at 240V AC. By the time it was discovered, maggots had eaten our experimenter.

The next step to testing amphibians is to test mammals. The famous James Prescott Joule gave his friends shocks from Leyden jars.

He used 'galvanism' in experiments on a lame carthorse, and even carried out a series of tests on a woman servant with a powerful voltaic battery. The voltage was steadily increased and she was told to report her sensations — she did so until she became unconscious at which point Joule advisedly terminated his experiments.

Experiments on living human volunteers only form a small part of the data that follows. Certainly Professor Biegelmeier's data came from a living person — himself. The rest is from experiments mainly on corpses and reports from accidents.

Disclaimer

No voltages or currents are unequivocally safe. This article describes the hazards of electricity, but even where the data suggests some situation may be relatively safe, no guarantee can be given by the author or the publisher to the veracity of the experimental reports. An unsuspected heart condition can make even 20 microamperes fatal. A faulty 7 volt underwater pool light has caused a swimmer to drown through paralysis. Be warned!

Electrocution Statistics

In 1988, the last period for which data is available, 68 people were accidentally killed by electricity in Australia. The deaths can be broken down into six groups, with examples given for each.

Group 1: Electricity workers — supply authority (3), others (9).

An electrical contractor received a fatal shock of 240V when he contacted exposed energised terminals of a thermostat while his other hand was in contact with the earthed metal of a sterilizer cabinet. Another electrical contractor died when he touched conductors energised from a portable generator and received 240V hand to hand.

Group 2: Overhead power wire accidents — fallen conductor (2), contact with conductor in position (14).

A farmer received a fatal shock of 6.3kV when his tip truck touched overhead wires. A farm worker, cleaning mice out of an aluminium irrigation pipe, stood the pipe on its end and made contact with the 6.3kV overhead conductors. A builder's labourer was putting a reinforcing rod down a concrete block wall when the upper end touched 33kV overhead wires — he died from a 19.1kV shock. Other lethal conductors included fallen tree branches, a concrete pumping boom and a boat mast.

Supply authority workers take special precautions when working with overhead wires. With the three-phase 415V wires, provided they are not touching earth or another phase, they can work on one phase wire safely. They are expected to wear insulated boots and at least one glove. Birds too can land on one wire safely, but if you've ever seen a possum stretch from one wire to another you'll know it's not safe to do this.

When working with high voltages such as 33kV, other precautions are needed. Even three metres away, the field about the wire is so strong that it makes the hair on your neck stand up. It's a feeling that some linesmen find so unsettling that they stay with 415V jobs. Tools on long wooden poles are used to minimise the risk of electrocution. If you've ever touched one terminal of a 10,000V induction coil while being completely insulated, you will have felt a small current of 2-3mA flow through your fingers. It's quite uncomfortable.

Group 3: Fixed wiring in consumer premises (8) — made up of home repairs or perhaps unauthorised repairs by a third party (2), and others (6).

These others include a builder who died when he grasped an earthed metal rod while in contact with a metal house frame — a coach screw holding the frame in place had pierced a 240V cable and made the frame 'live'. Another fatality was caused by an open circuit in an earth wire. The active and earth had arced in an appliance causing the earth wire to melt, but the earth wire had become live at its remote end. Even though the fuse had blown, it had been replaced unknowingly. Yet another case involved a sheet of roofing iron which was pushed up under an existing sheet. It cut into the cable in the roof, energising the iron, and killed a young boy who touched it.

If you don't lower your mast it may be lowered for you. Several people have been killed this way.

Earth leakage circuit breakers have been around for the past decade, but many householders still find $170 too much to pay for safety.

Group 4: Flexible cords (18) — including unauthorised repair work to a caravan.

In the case of the caravan, its internal wiring had not been connected to earth and the shower heater developed a short circuit to its metal case. The victim completed the circuit to the earthed metal shower-tray when he grabbed the live hand-held shower rose. Yet another death occurred when the victim failed to switch off (and disconnect) a flexible cord from the power point before making repairs. Other examples include an incorrectly wired plug to a portable TV set flex which caused death when the user touched the metal walls of a shed, and a portable generator connected to a house by inappropriate wiring which killed a milk vendor.

Inappropriate wiring of a three-pin plug can mean reversing the neutral and earth. The current path is then active to earth so the appliance will work providing there is no earth leakage circuit breaker connected. The case of the appliance will be connected to neutral if the case is normally earthed.

But the real drama arises when the power point has its active and neutral reversed, as often happens with home handyman wiring. The case is then active, with the neutral and earth connected to each other. Of course it won't work, but touch the case and touch a sink and you're in big trouble. A few years ago, an Australian-made double adapter featured this reversal of active and neutral because it was easier to build them like this. They are no longer approved.

Group 5: Faulty appliances and lamps (13) — including a student who reached for a towel and dislodged a hairdryer which fell into the bath with her. Another was an apprentice boilermaker who received a fatal 77V AC shock when he touched the electrode

of a welding lead while welding metal. His gloves and clothes were damp with perspiration. A man working under a very low set house with a lead light died when the glass bulb broke and he contacted the filament supports. There was no guard protecting the bulb.

Group 6: Unknown cause, but identified as electrocution (1).

Lightning

Lightning kills because it is both a high voltage and a large current. It kills people either directly or by striking nearby trees or the ground. To appreciate how this lethal bolt is delivered, it is helpful to understand how lightning forms.

A popular model is this: in the cold upper and middle regions of a cloud, large falling raindrops, hailstones and ice pellets acquire negative charges as they fall. On collision with smaller water droplets and ice crystals suspended within a cloud, they transfer their negative charge. The upper portion of a cloud is left with a positive charge and the bottom is mostly negative. A potential difference of between one million and three million volts per metre is produced. A typical cloud-to-ground lightning flash begins with the formation of an intermittent, highly branched discharge, called a stepped leader, that spreads downwards. The leader carries the negative charge towards the ground, along the tips of a branching discharge and leaves a trail of ionised air. At a height of about 100 metres, the negative charge in the air attracts a positive charge just above the ground. The electric field intensity becomes enormous, and streamers of charge propagate upwards until one or more attach to the leader, usually between 10 and 20 metres above the ground. When contact is made, the first return stroke occurs. This is the start of the lightning 'strike'. It is over in less than one thousandth of a second.

The current may peak at between 10,000 and 40,000 amperes, although the sustained current is typically a few hundred amperes.

A typical lightning bolt represents a potential difference of several hundred million volts and transfers 10 or more coulombs of charge (about 10^{20} electrons) to the ground. One coulomb per second is defined as one ampere of current, so 10 coulombs in 1/1000s is 10,000 amperes. Whether a lightning strike kills or not depends on which organs the current passes through. A 10-year-old boy playing with a golf club was struck directly in May 1976. His heart stopped, but he was revived by neighbours. Only about one quarter of people struck are killed. Metal fences, railway lines and pipes can conduct lightning that has struck some distance away.

It was sheer luck that Benjamin Franklin survived his kite flying experiments in a thunderstorm. The potential can be millions of volts.

In July 1955, 47 people were injured and two killed as current passed along metal rails at Royal Ascot races. Even after the storm has passed, accumulated charge on metal objects can still cause harm. The large current in a discharge can raise air temperatures to 30,000°C, which creates a huge shock wave of 10-30 atmospheres and can throw victims into the air. If the lightning strikes an object with moisture in it, the moisture can boil, causing explosive expansion. In July 1974, an 11-year-old girl was struck by pieces of an exploded oak tree which fractured her skull and she died. The explosive force has been reckoned as equal to 250kg of TNT. In Dublin in 1984, a golfer was struck as he carried a bag of clubs on his shoulder. The subsequent gas expansion ruptured his eardrums and perforated his bowel in six places.

When lightning strikes the ground, large voltage gradients are created on the surface as the current propagates outward. The further two points are apart on the ground, the greater the potential difference. A cow, having a larger distance between front and back legs may be killed,whereas a person may not. So crouch with your feet together and hands on your knees — don't lie down. If your clothes are wet, current is conducted over your body rather than through it. You might get burnt, but the current may bypass your heart.

Protection Devices

If you look at the history of protection against electric shock, the first measure was to avoid 'direct contact' by basic insulation, barriers, enclosures or placing the live part out of reach. Plastic coating on wires, locked switchboxes and high overhead wires fall into this first line of defence.

The next step was to protect against shock where the insulation had failed due to aging or mechanical stresses. This 'indirect contact' included protective earthing, protective multiple earthing (earthing the neutral) and isolating transformers. Opto-isolators are common in circuits in this magazine. These fault protection measures can also be defeated, especially when using portable equipment. Earth wires may be connected up the wrong way as mentioned earlier, double insulation may fail, covers break, live parts may become accessible and appliances can fall into bathtubs.

The past decade has seen great strides in the development of additional protection with a *core balance earth leakage circuit breaker* (ELCB).

These units guard against electrocution should the user come in contact with either the active and earth or neutral and earth, which is how 85% of electrocutions in Australia occur. Not all of these deaths could be prevented with a ELCB, however, as many occurred with high voltage overhead currents.

An ELCB monitors and compares the current flow in both active and neutral circuits. Should the current flow become sufficiently unbalanced, it indicates that some of the current in the active is leaking to earth and not returning through the neutral. If an imbalance occurs, an electronic switch trips and disconnects both active and neutral. The most common models have a specified trip sensitivity of 30mA. They trip at about 22mA and the shock duration will be limited to 10ms to 30ms.

Of course, the fact that they trip at 22mA does not mean that the current is limited to 22mA. With a person making a good contact with earth, he or she could experience quite a large current before it is switched off.

The best ELCBs have amplification, and if the peak of the voltage cycle occurs when the imbalance is detected, the shock duration is about 10ms. If the touch voltage occurs at the zero point of the AC cycle, tripping time is about 20ms.

Experiments by Biegelmeier have shown that even if the shock started within the vulnerable part of the cardiac cycle, fibrillation did not occur, although painful muscular contractions did. Tests have shown that about 500mA for 30ms would be needed to cause fibrillation.

The future possibilities of ELCBs are extraordinary for saving human lives. The problem is that not all households have them, even though $170 installed sounds cheap. However, they do not protect the user who touches both the active and neutral as the current just flows through the body and not the appliance.

Power Bandits

Most cases of electrocution are accidental. In some cases the users are doing something illegal and come unstuck. One case is the 'power bandits' who steal electricity from the supply authority.

They either make the watt-hour meter go slow or backwards, or connect up to the mains before the meter. In all States except Queensland, the mains go into the meter then to the main switch. In Queensland, the mains go to the switch first then to the meter, which makes illegal connections much simpler. In one incredibly dangerous case, a farmer connected the top wire of his fence to the active to run an irrigation pump some distance away at his dam. The earth (terra firma, not neutral) provided the return path. One electrician in my street took free power for an oven he used in baking armatures. The panic began when supply authority electricians arrived in our street to link earth and neutral as part of the multiple earth neutral conversions in 1955. He hung blankets around the switchboard and, using a extension lead managed a hasty re-conversion before they found out what he'd been up to. It seemed funny at the time. Even if he had been electrocuted, it wouldn't have registered on the meter.

Power bandits use blackboxes to make the meter go backwards. The thick wire goes to earth but carries half an ampere and can be lethal.

With watt-hour meters, things aren't so simple. A watt-hour meter is basically a split-phase motor in which the active line of the mains feeds through a heavy coil in the meter. A coil of thin wire sits across the active and neutral. Between the two coils is an aluminium disk which turns in response to eddy currents.

Permanent magnets slow the disc down and allow calibration, so that 1kWh equals say 266.6 revolutions. Stronger magnets could increase the retarding field, but most attempts seem to demagnetise the magnets and allow it to run faster. Some people have bored holes in the case to stop the disc moving, but have ended up drilling into the active and stopping their hearts instead.

A more dangerous method involves using an illegal $300 'black box'. One type involves a home-made transformer which causes the meter to run backwards. One of the leads has a bulldog clip so that it can be attached to earth, but unfortunately a current of about a half an ampere flows through this wire. Users, thinking it is just a safety wire to earth, are given one almighty shock to prove otherwise. And 500mA at 240V is a big enough shock to end your worries about free electricity. In S.E Queensland there have been 29 successful prosecutions so far in the past three years, with $380,000 being paid back.

There is a more insidious problem — unsuspecting electrical contractors or supply authority workers' lives are at risk when they go to work in premises with modified power supplies. Neighbours too can find themselves a part of the modification, if they share a common earth via conducting water mains and a fault develops.

There are hundreds of stories to tell, but those above illustrate some of the major dangers of electricity. It's those non-lethal shocks like the electric fence, the forgotten capacitor in the TV set and those that are cut off quickly by the circuit breakers that make people complacent.

Electricians who give their apprentices 'safe' 1000 volt shocks from the Megger may be contributing to complacency. Perhaps if some readers are chastened by this article it'll be worthwhile. I know I was.

(To be continued) ■

Moffat's Madhouse...

by TOM MOFFAT

The great pinball adventure

Video games? Nah! How very dreary. All you young people out there who spend your spare time locked into a coma of computer 'action' don't know what you're missing. Well, maybe I shouldn't say that, after all I spent much of *my* youth shoving coins into that great time-waster of the sixties, the pinball machine. They're still around, of course, although the modern versions seem to incorporate more electronics and less of the electro-mechanical joys of the earlier models. Regardless, I'm still hooked on the things, 30 years on.

I belong to a somewhat strange computer users' group, which in the 10 years of its existence hasn't conducted one instructional lecture or passed one motion or resolution at a formal meeting. Instead we sit around in the cozy meeting room, drinking beer and fiddling about with computers that members bring on the night.

Many members are electronics people, and others can bring their faulty machines along for a committee-based repair job, where one guy actually works on the machine and the rest huddle around giving 'advice'. One night we totally wrecked a fellow's Microbee; he never came back again.

Just outside the meeting room door stands a big, glorious, flashy, 1960's-issue electromechanical pinball machine called 'Centigrade 37' — an American product that obviously hit our shores around the time of metric conversion, because it displays the Fahrenheit equivalent as well. The machine features a large thermometer in which the mercury climbs as you rack up the score. The 'mercury' is in fact a red nylon belt, wound around a drum at the bottom and pulled upward by a spring. The drum has a ratchet arrangement that lets the mercury click up a notch with each pulse of a solenoid.

On the machine's playing table are the usual solenoid-powered bumpers to send the ball flying back when they're hit. There are chutes you can roll through to gain up to 5000 points a time, and things called 'drops' in pinball terminology that fall down into the table when you hit them. You get a 'special when lit' on other targets when you knock out all four drops, producing even higher scores.

At the bottom of the table is the dreaded hole where you lose the ball, guarded on each side by button-operated flippers which swat the ball back up the table. If you're clever you can get it right back up to the top, effectively giving yourself another ball on top of the standard five per game.

For a long time on *Centigrade 37*, the right-hand flipper was badly worn, so all it was really good for was nursing the ball over toward the left flipper where you could give it a really good belt.

Successful pinball play depends on keeping the ball moving as fast as possible. Whenever it hits a bumper or you use a flipper, a sharp nudge to the table will add more power to whatever is accelerating the ball. Any decent pinball machine has detectors to prevent you doing this, and if they work you get a 'TILT' message and lose the ball; maybe even the game.

Centigrade 37 has a clever array of wiggle detectors and tremblers to detect movement, and there's even another ball that runs down a metal track inside if you try to lift the machine off the floor. But I have discovered you can confuse the wiggle detector by keeping the machine gently rocking fore-and-aft all the time, so a good whack isn't such a shock to it.

Even with the latest you-beauty '386 IBM-PC's to play with, the pinball machine is still the star of the show on computer group nights.

There is a constant competition running, and high scores are carefully noted as middle-aged men stand at the machine, dancing about and stomping and rocking and flipping as an appreciative cheer squad gives moral support. We have worked out that the ultimate high score is 200,000, since the machine has no way of counting past that number.

One meeting last winter was on a cold and snowy night. Only four people turned up, and there were no computers — nobody was game to carry them to the meeting, through such awful weather. So the four of us sat there huddled around the heater, sinking stubbies and waffling about computers. I stuck with it for a while, but then I realized I wasn't going to make it through the night without my monthly 'fix' of pinball.

I left them with it and ventured out into the freezing cold hallway. When I plugged in the pinball machine it powered up with its usual routine of clunks, clicks, buzzes and dings to announce it was ready for action. And action it was!

During the previous month someone had fixed the lame right-hand flipper, so it slung the ball with a mighty force at the merest touch of the button. And the bumpers seemed more lively, too. My theory is that the cold weather had lowered the resistance in the solenoids so they drew more current, producing more power. Anyhow *Centigrade 37* was going like a rocket, and rock it I did to enhance the play further.

You know how sometimes you can't do anything wrong? Well that night each ball just REFUSED to go down the lost-ball chute until it had traversed the table up and down several times. The machine seemed to be alive — I could feel every clunk and bang of the solenoids transmitted through the table to my fingertips. Lights flashed, bells binged and bonged, and the ball seemed to be moving faster than a speeding bullet.

My 'personal best' on the machine had been 176,000 points, but when I finally sneaked a look at the score it was already past 180,000 — with two balls still left to play.

"I'm going to break 200,000!" I shouted, hoping to draw an audience out of the meeting room. But the door was

closed and the heater was humming, and nobody heard me. I was all alone in my moment of glory.

Clunk! Thunk! Whack! Ding-dong! Amidst a cacophony of noise and flashing lights, the thermometer suddenly hit the top, and above it a bright yellow light began flashing. We'd never seen that before — what did it mean?

Then the score counter passed 200,000, but what a disappointment! It couldn't go anywhere else, so it just started counting from 100,000 again.

But then — strange things happened. The thermometer stuck at the top. And for some reason the special-when-lit targets stayed lit all the time, even after I'd hit them. Soon everything was special, and the score rocketed up. Then the ball counter went dark. With 230,000 points, well past its maximum, the machine was now giving infinite balls and specials on everything!

It had, in effect, given up. Resigned. Retired from the game. From now on, playing the machine was like shooting ducks in a pond; the challenge had gone. So I decided to put it out of its misery, and I hit the reset button to start a new game (the coin slot had long since been removed).

No burr-ups and dings and bongs this time, just one forlorn clunk. None of the lights on the table would work; the flippers and bumpers were dead. The damn thing had snuffed it.

So I strode into the meeting room and announced: "I have just hit 230,000" ("Yaayyy!"). "And I've just blown up the pinball machine" ("Boooo...")

Well, that meant action stations — time to fix it! Out of the room swarmed this group of heavies, the same people who'd sent a poor computer to Microbee Heaven. They were obviously itching to go, waiting for a good excuse to tear into the pinball machine.

Soon the back had been removed, and the main chassis was dropped down on its hinges (this thing was obviously built with the serviceman in mind). The glass was removed from the playing table, and the table was then raised on *its* hinges.

There were bits of pinball machine protruding everywhere. If you can imagine what a pinball machine would look like if someone dropped a stick of gelignite in it, well, that's what *Centigrade 37* looked like.

And everywhere, on every available surface, screwed to metal frames and blocks of wood — relays! Simple spring-return relays, bistable relays, rotary things that looked like switches out of a telephone exchange. Lights and bumpers and solenoids in great profusion. and thick bundles of wires laced together with waxed cord. But nowhere were the things we work with today. Not a transistor, capacitor, resistor, IC, or even a valve. Just switches and relays.

The key word above is 'telephone exchange', the repository of much electromechanical knowledge.

One of the attending pinball-surgeons was in real life a Telecom technician, who prettywell ran the telephone exchange in a nearby country town. I had also done my time with the American Telephone and Telegraph Company, back in the 1960's when relays ruled. The other two fellows seemed to be pretty well up on electromechanical technology too, being of middle age. Relays? No problem.

Deep within the machine we found, rolled up in a paper tube, a circuit diagram. This was a bit old and crumbly, like the Dead Sea Scrolls, but it was just what we needed. We retired back to the meeting room, and the heater, to study the circuit and try to work out the machine's problem using sheer intellect. The circuit was probably something that most young technicians have never seen. Relay coils were shown as blocks and their contacts as X's or lines, for normally-open or normally-closed.

From this circuit we were able to deduce that the machine contained such circuits as bistable multivibrators (flip-flops) and even a rudimentary random number generator based on what detectors the ball rolled over in what order.

Mr Telecom's eyes lit up; he was right at home in this circuit. "Somebody check to see if the C-relay is operating", he said, studying the yellowed sheet of paper. "Now the L-relay."

Yes, it was OK too. After more line-tracing and head scratching, he finally announced that the only way the machine could be acting up in the way it was, was if there was a fault in the ball counter.

My goodness. In all the excitement, I had neglected to mention that the machine had started handing out infinite balls, just before it carked it. And Mr Telecom looked like he'd nutted out the answer, just by following the circuit diagram. All hands raced for the ball counter, this time led by a fellow who was a specialist in traffic light controllers. After a quick disassembly he announced, "It's stuck!".

And so it was, simply gummed up. A quick squirt of CRC put it right, and restored the machine to its former glory.

What happened? Maybe the cold weather had thickened the ball counter's lubricating grease (it was a solenoid-driven rotary switch).

I would of course prefer to think that the ball counter seized up from shame, when the pinball machine realized it was going to be so terribly beaten. Anyhow, once it was restored to life the machine became very reluctant to allow any scores above 50,000. It had learned its lesson.

I know it's a well worn cliche, but they certainly don't make things like they used to. No way in the world could you have as much fun with a computer as we've had with that pinball machine — playing it, abusing it, blowing it up, and then finally resorting to the old hands-on repair skills in its hour of need. May pinball machines, like old Holdens and DC-3 aircraft, live forever! ■

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FORUM

Conducted by Jim Rowe

More about FM stereo and how switching decoders work

After last month's necessary detour into aspects of project safety, we can at last return to look at some of the letters and information that arrived in response to the discussion of FM stereo decoding, in the June issue. You may recall that the key question raised by reader Phil Allison was this: How is it possible for a composite FM stereo 'multiplex' signal to be decoded using simple time-division switching?

In the June column, I tried to provide at least a basic qualitative answer to Mr Allison's question by referring back to various published descriptions of the 'pilot tone' composite stereo signal itself, and the way it was traditionally generated. I noted that although some books and references seemed rather vague about the details, the crucial point seemed to be that regardless of the way the signal was *actually* generated, it was nevertheless essentially *equivalent* to a time-division sampling or 'multiplexing' of the original left and right audio signals. Hence because of this a valid way of decoding the signal was to use the complementary process of synchronised time-division *demultiplexing*.

I had to admit, though, that due to the lack of detailed information to hand, this explanation was little more than intuition. And I also had to admit that I couldn't really explain why practical switching-type decoders seemed to need a carefully controlled amount of 'crosstalk' injected into the decoding switch, in order to achieve maximum separation of the decoded stereo signals.

Well, before I go any further it has to be said that many of the letters that arrived in response to the June column have come to my rescue. In fact I've been almost *buried* in further information, detailed explanations and copies of relevant reference papers and articles. It all goes to show what a helpful and friendly bunch of people we have out there, among *EA*'s readers!

My grateful thanks to all of the readers concerned, and I only regret that it won't be feasible to quote from every one of your letters. In view of the embarrassment of riches that you've showered upon me, all I can try to do is select from them what seem to me the most clear and satisfying explanations, and present these...

But where to begin? Perhaps by noting that a number of readers, including Mr A.H. Freeman of Wollstonecraft in Sydney and Mr Bill Metzenthen of Ormond in Victoria, gave graphical demonstrations of the similarity between a 'traditional' stereo FM composite signal and a time-division multiplex signal, in the time domain.

Mr Metzenthen had gone to a great deal of trouble to produce a series of diagrams with a computer drawing package, to show how difference and sum signals could be switched at subcarrier frequency and then the resulting signals re-combined again via a switching de-

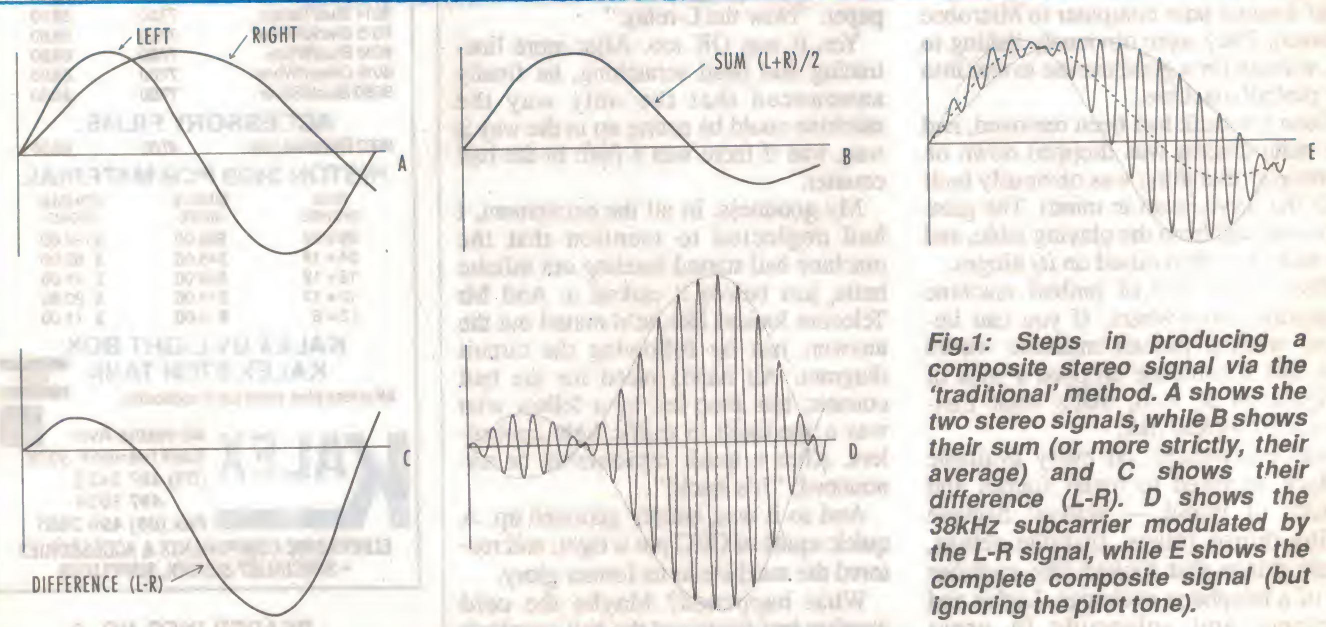


Fig.1: Steps in producing a composite stereo signal via the 'traditional' method. A shows the two stereo signals, while B shows their sum (or more strictly, their average) and C shows their difference (L-R). D shows the 38kHz subcarrier modulated by the L-R signal, while E shows the complete composite signal (but ignoring the pilot tone).

coder to reconstruct the original signals. These were quite informative, although I actually found Mr Freeman's hand-drawn diagrams a little easier to follow. As it happens, however, very similar diagrams to these appear in a paper sent in by another reader — so I'll present and discuss these further shortly.

Mr Metzenthen also very kindly sent in a set of spectrum plots — for the basic composite stereo signal, a switched multiplex signal and a signal decoded with a switching decoder. These are very helpful indeed, and I'll reproduce some of these also a little later in the discussion.

Deliberate crosstalk

By the way, both Mr Freeman and Mr Metzenthen throw more light on the fact that a switching decoder needs a certain amount of deliberate 'crosstalk' in order to give optimum stereo separation. Here's the way Mr Freeman explains it:

Because the demultiplexed L+R signal is a square wave, while the demultiplexed L-R is half a sinewave, the L-R component is smaller than it should be. I think it will be 0.56 of its correct value.

So the signal in the time slots when the subcarrier signal is in phase with the baseband signal is (L+R)+0.56(L-R) or 2L + 0.44R (sorry for the algebra, but I can't see how to avoid it). The signal in the other slot is 2R + 0.44L. The stereo separation is not perfect. However by subtracting from the left slot some of the signal from the right slot, and vice-versa, it is possible to get perfect separation. If one subtracts 0.22 of the right signal from the left, one gets 1.9L + 0R; the same applies for the left channel.

Thanks for that contribution, Mr Freeman, and it does make things clearer — although I can't quite follow your maths. With a factor of 0.56 I can't see how you get those 2L and 2R terms; according to my algebra, you should get 1.56L + 0.44R and vice-versa...

Here's the way Mr Metzenthen explains the same point:

The 'problem' with the [raw demultiplexed signals], *which stops us simply filtering them to recover the L and R signals, lies in the fact that there is an imbalance between the L+R and L-R signals. In fact the L-R contribution is too small, by a factor of $\pi/2$.*

A rough argument in favour of the $\pi/2$ factor is as follows. Notice that the L-R signal contributes essentially half-sinewave pulses, whilst the L+R signal contributes essentially square pulses. It is a simple calculus exercise to prove that the ratio of the average values of these types of pulse is $\pi/2$.

The results of switching and filtering can therefore be represented by one signal which is $(L + \alpha R)$, and another which is $(\alpha L + R)$, where α has a value of $(1 - 2/\pi)/(1 + 2/\pi)$, or approximately 0.2220. The separate L and R signals can be recovered from these in the obvious way by simple subtractions; just subtract α times one signal from the other and we recover L or R.

The circuit in your Fig.3 does the subtraction before filtering. Simplified circuit analysis shows that the (signal) collector current of Q43 is approximately $-430/(1590 + r_e + 430)$ times that of Q44, where r_e is that of Q43. Neglecting r_e (which depends upon the emitter current and will probably be in the order of 50 ohms), we get 0.2129 which is reasonably close to our required value. This error in the ratio is not as serious as it might appear; it represents a channel separation of about 40dB. Anyway, I would expect that the resistor values on the circuit diagram are not meant to be taken as typical on-chip values.

Thanks for your explanation too, Mr Metzenthen. For the benefit of readers who are puzzled about the reference to the L+R signal being formed from

'square' pulses, and the L-R signal from half-sinewave pulses, perhaps I should endeavour to explain.

As I understand it, the reasoning behind this is that the composite stereo signal fed to the switching decoder consists of both the L+R 'baseband' signal, and the L-R difference signal — added together. And whereas the L+R signal is simply an analog sum of the original stereo signals, and therefore continuous, the L-R signal is in fact a double-sideband suppressed carrier signal centred on the 38kHz subcarrier frequency.

Not continuous

This means that the L-R signal is *not* continuous, but in fact a 38kHz DSB modulation envelope. As a result, when the composite signal is passed through the switching decoder, and demultiplexed by a switch synchronised to the original 38kHz subcarrier, the two outputs each consist of the sum of two somewhat different pulse components: those from the continuous L+R signal, and those from the L-R envelope which are essentially half-cycle segments of the 38kHz subcarrier.

If they were both either chopped continuous signals or half-sinewave signals, we would presumably get perfect decoding without any 'fiddling'. But since we're in fact combining one of each, the resulting discrepancy makes it necessary to bring in that intentional crosstalk of 0.22, to get correct balancing.

Get the idea? Don't worry too much if you don't, however, because things should become clearer shortly.

Getting back to the original question about the whole idea of decoding the composite stereo signal by time-domain switching, I mentioned earlier that I had found Mr Freeman's diagrams quite helpful in showing the similarity between the composite signal and a time-domain multiplexed signal. As it happens, I found very similar diagrams in a photocopy of a paper sent in by a reader from Salisbury, Queensland. The reader concerned describes himself as a 'shy fellow', who wishes to be described merely by his initials: B.R.

The paper sent in by B.R. was written by Carl G. Eilers, a research engineer at Zenith Radio Corporation, and apparently one of the original developers of the pilot-tone system (which was developed jointly by Zenith and GE, and first adopted by the USA in June 1961). Mr Eilers' paper was published originally in the August 1961 issue of the long established US journal *Audio*, and was entitled 'FM Stereo: Time-Division Approach'.

I won't try to reproduce or even paraphrase all of Mr Eilers' paper, because it uses quite a lot of maths and goes into a number of aspects of the stereo encoding process which aren't really relevant to the current discussion. But it does make quite clear that Mr Eilers and the other developers of the pilot-tone FM stereo system were very much aware of the fact that it could be visualised in terms of time-domain multiplexing, right from the start, and that they were also well aware of the possibility of using a switching-type decoder. In fact his paper actually gives the circuit for such a decoder, based on valves — and with a 'crosstalk' mixing circuit (in this case after the demultiplexing switch), to achieve optimum channel separation.

But the explanatory diagrams given in the Eilers paper are very helpful, and by redrawing these together with a couple of those suggested by Mr Freeman, I think I've come up with some diagrams which should help us all to understand the whole encoding and decoding process better.

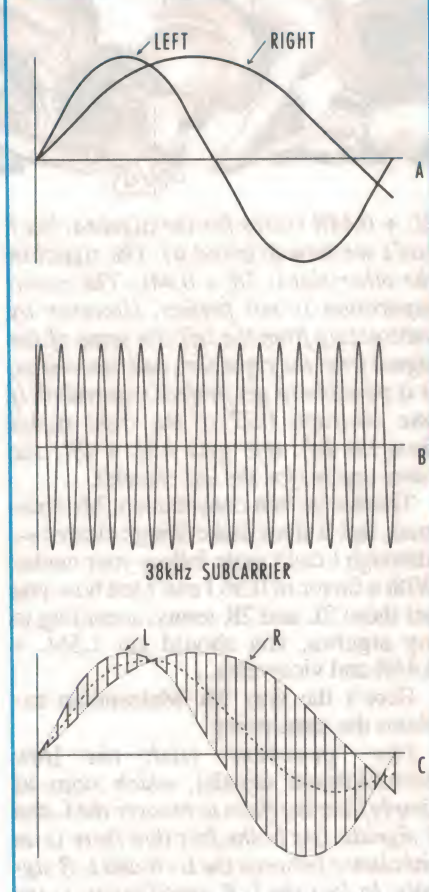


Fig.2: The development of a time-domain multiplexed stereo signal. A shows the original stereo signals, B the 38kHz sampling signal, and C the effect of using B to switch between the L and R signals. Compare this with the waveform of Fig.1E...

The first set of diagrams are shown in Fig.1. Here short sections of the two original stereo signals are shown in A, with their algebraic sum (the L+R signal) shown in B. This is of course also the 'mono' or baseband signal component of our stereo composite signal.

In C is shown the basic difference or L-R signal, while D shows the corresponding envelope of the signal produced when this L-R signal is used to modulate the 38kHz subcarrier. Note that there are phase discontinuities in this signal, because it is generated using 'DSB' — double sideband, suppressed carrier modulation. The signal shown in D is of course the other main component of our stereo composite signal — the one carrying the stereo difference signal.

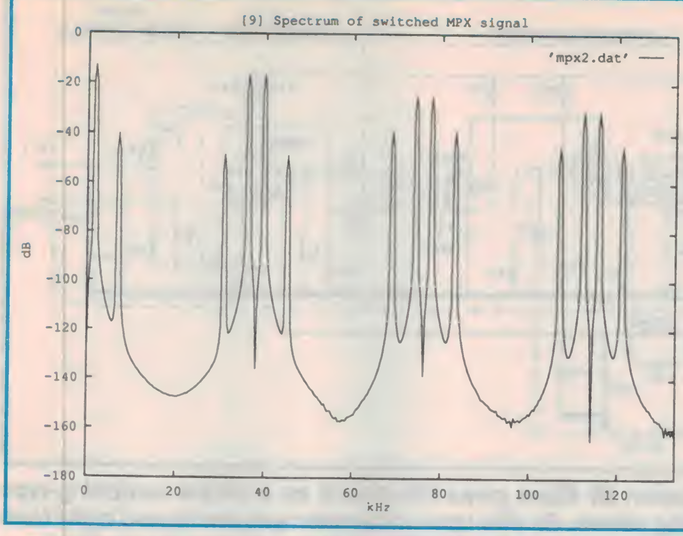
Finally, in E, we see the signal that is produced when the baseband L+R mono signal of B is added to the modulated L-R stereo subcarrier signal of D. This is effectively what the composite stereo modulation signal looks like, apart from the low level 19kHz pilot tone (which we can ignore here, because it's used only for synchronising the receiving decoder to the transmitter's 38kHz subcarrier oscillator).

Things to note

Now at this stage there are two important things to note about the waveform in Fig.1E. The first is that the instantaneous *average* level of the waveform is directly proportional to the L+R signal, which is evident if you compare the dashed line with the curve in B. And this makes sense, of course; after all, the composite signal is formed by *adding* the signals of B and D, and the average value of waveform D will always be zero.

The other point to note is that if you look carefully, you'll see that the envelopes formed by the peaks of alternate subcarrier half-cycles in the waveform of E are directly proportional to the individual waveforms of our two original stereo signals, in A. And this makes sense too, when you think about it: to produce the signal of E we're adding the L+R signal and a signal which is effectively the (L-R) signal multiplied by $\cos 2\pi f_{sc} t$ (where f_{sc} is the subcarrier frequency of 38kHz). Hence at the signal peaks, where the subcarrier cosine signal has a value of ± 1, the instantaneous signal level will simply be equal to (L+R) ± (L-R) — giving 2L or 2R, for alternate half cycles.

Now let's look at the waveforms



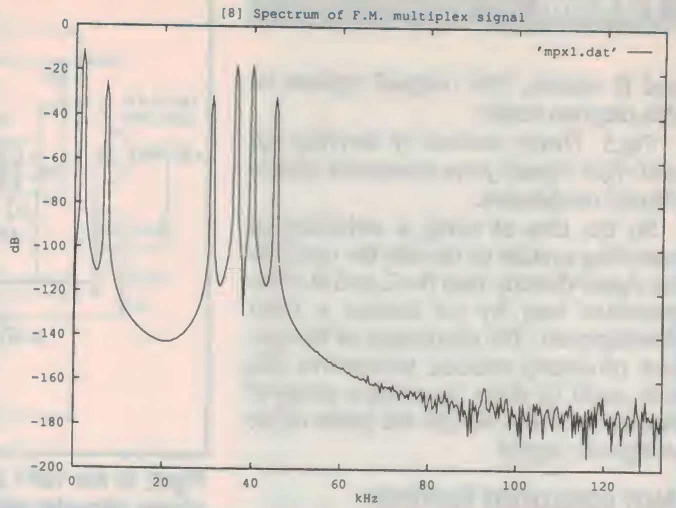


Fig.3 (left): Mr Metzenthen's spectrum plot for a time-multiplexed stereo signal like that of Fig.2C. As well as the original L and R signals, it includes matched pairs of components centred on 38kHz, 76kHz, 114kHz and so on. Fig.4 (right): As only the components centred on 38kHz are essential to convey the original stereo information, we can filter out the rest by passing the signal through a 53kHz low-pass filter to produce the spectrum shown...

shown in Fig.2. Here we see in A our two stereo signals again, exactly the same as in Fig.1A. And in B we see the 38kHz subcarrier signal, which in this case is going to be squared up, and used to drive directly a time-multiplexing switch which selects the L signal during positive half-cycles of the subcarrier, and the R signal during negative half-cycles.

When we do this, the signal waveform we get will look very much like that shown in C. As you can see, it consists of a train of pulses of the same width (26.315us), with the value of alternate pulses corresponding to the L and R waveforms respectively.

Now compare the waveform of Fig.2C with that of Fig.1E. What do you see?

Very little difference

That's right, there's not a great deal of difference. In fact they're essentially the same, except that in the case of 1E the waveform is made up of half-sinewave pulses, while that of 2C is made up of 'square' pulses.

Now we *could* use the time-multiplexed stereo signal of Fig.2C to frequency modulate our FM station's carrier, instead of the normal composite signal. But the disadvantage of doing this would be that with its sharp rectangular transitions, the signal has a high harmonic content and would require a very high modulation bandwidth (and channel bandwidth) to convey it faithfully to the demultiplexer at the receiving end. This would be rather wasteful of spectrum space, and as it turns out, we don't really need to do so.

Here's where a couple of the curves supplied by Mr Metzenthen can help us see things more clearly. In Fig.3 we see his spectrum plot for the kind of switched multiplex signal we have produced in Fig.2C, assuming the original L and R signals have frequencies of around 1.5kHz and 7kHz. As you can see, the switched signal contains components at the original frequencies (the baseband sum components), matched pairs of 'high band' components centred around 38kHz, and also further matched pairs of components centred around 76kHz (the second harmonic of 38kHz), 114kHz (the third harmonic of 38kHz), and so on.

Largely redundant

It turns out that only the first set of these matched pairs of components — those centred around 38kHz — are essential if we want to convey all of the original stereo information to the receiving decoder; the rest are largely redundant. Therefore, in order to save spectrum space, we can pass the signal of Fig.2C through a low-pass filter which is designed to reject all modulation components above about 53kHz.

When we do this, we end up with a signal spectrum which is shown in Mr Metzenthen's plot of Fig.4. And what do you think the waveform of our time-multiplexed signal now looks like, after passing through this low-pass filtering?

Right, you guessed it — just like the composite stereo signal waveform of Fig.1E!

So our composite stereo signal of Fig.1E with its half-sinewave pulses at 38kHz can actually be produced *either* in the 'traditional' way, by mixing the L+R mono signal with the output of a 38kHz DSB modulator fed with the L-R signal, *or* by directly time-multiplexing the original L and R signals, and passing the switching multiplexer's output through a 53kHz low-pass filter. There's essentially no difference; each approach produces virtually the same result — showing that the two methods are indeed basically equivalent.

Switching makes sense

This being the case, of course, the idea of using a switching-type demultiplexer in the receiver now also makes sense. In fact it's obviously just as logical as using a 'traditional' decoder with baseband filter for the L+R signal, a synchronous DSB demodulator for the L-R signal, and then an addition/subtraction matrix to recreate the original L and R signals.

If anything, the switching decoder makes even more sense, because it tends to be somewhat simpler and cheaper, while delivering results that are at least as good.

As noted earlier, the thing I found particularly interesting about Carl Eilers' paper is the way it shows that he and his colleagues at Zenith clearly envisaged the use of switching-type decoders, right back in 1961 when their 'pilot tone' stereo system was being introduced.

For example Fig.5 shows one of the diagrams given in the original paper, showing how a pair of 'interleaved unit impulse function' signals (or chains of narrow sampling pulses) could be used to sample the peaks of the composite stereo signal, to recreate the original L

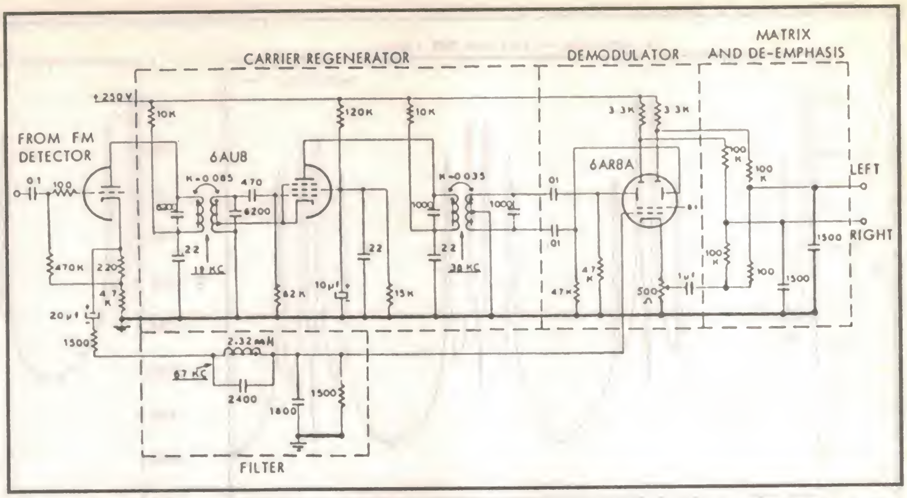


Fig.6: In his 1961 paper, Mr Eilers gives this circuit for a simple switching-type stereo decoder using valves. So this type of decoder was envisaged right from the start, by the developers of the Zenith-GE 'pilot tone' system themselves.

and R signals. The original caption on this diagram reads:

Fig.5. Direct method of deriving left and right signals from composite stereophonic modulation.

So the idea of using a switching or sampling system to decode the composite signal directly into the L and R components was by no means a later development. The originators of the system obviously realised themselves that this could be done, by using a series of narrow pulses to sample the peaks of the composite signal.

Not explored further

Mr Eilers doesn't seem to explore this use of narrow sampling pulses any further, but does show mathematically in his paper that the composite signal of Fig.1E may be directly demodulated into the original stereo components, by multiplying it with a pair of signals corresponding to the function:

$1 \pm 2.\cos 2\pi f_{sc}t$,

where the result of the multiplication gives 2L when the sign in the above function is positive, and 2R when it is negative.

However he goes on to say that there is no practical signal waveform that corresponds to this function. The nearest to it is either a 38kHz square wave, which corresponds to the function:

$1 \pm (4.\cos 2\pi f_{sc}t)/\pi$

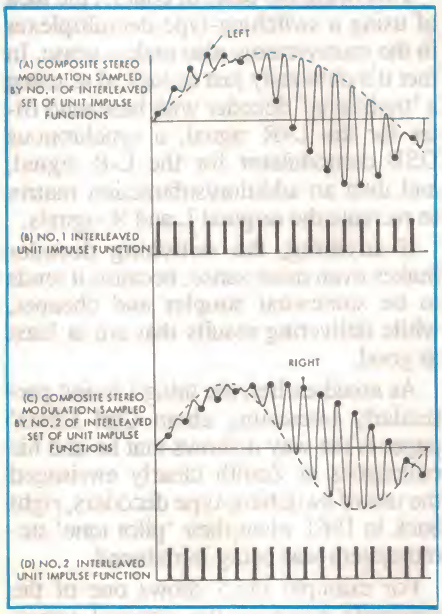


Fig.5: Carl Eilers' paper of 1961 shows that the Zenith engineers were well aware that the stereo multiplex signal could be decoded by digital sampling techniques, as this diagram shows.

or alternatively a 38kHz half-sinewave, corresponding to:

$1 \pm (\pi.\cos 2\pi f_{sc}t)/2$

He then notes that because the squarewave function is easier to generate electronically, this is the logical one to use. Accordingly he presents the maths covering the multiplication of the composite signal with the 38kHz squarewave — i.e., switched demultiplexing.

Decoding not perfect

His maths shows that in this case the decoding is not perfect, with each output having not just one of the original stereo signals, but a small amount of the other signal as well. He then goes on to show that this 'out of phase crosstalk' can be removed by adding a small amount of L+R signal to each of the decoded outputs, with an amplitude given by:

$(L+R).(-1 + 2/\pi)$

And in the remaining part of the paper, he describes a simple switching decoder using valves, which uses this 'post-switching' crosstalk cancellation. The circuit is reproduced here in Fig.6, and as you can see it uses a 6AU8 triode-pentode and a 6AR8A — which was a rather strange 'beam deflection tube' with a single cathode and control grid, but two deflection plates used to deflect the electron beam towards either of two main plates.

The triode section of the 6AU8 is used as an input buffer, with its plate feeding 19kHz pilot tone to the pentode section, which runs as an oscillator-doubler to regenerate the 38kHz subcarrier. The composite stereo signal itself passes from the cathode of the 6AU8 triode through a 67kHz low-pass/rejection filter, to the control grid of the 6AR8A, while the regenerated 38kHz subcarrier is fed to that valve's deflection plates, to switch the modulated beam back and forth between the output plates. Hence the 6AR8A acts as a switching demultiplexer, just like a modern IC decoder.

The only real difference here is that the crosstalk cancelling signal is added to the output signals after the switching, by means of the resistors fed from the 500-ohm pot in the cathode of the 6AR8A. As Mr Eilers states near the end of the paper, this pot was simply adjusted during setup of the decoder to give minimum crosstalk.

So there you are. Switch-type decoding or demultiplexing of the composite stereo signal is possible because the composite signal is indeed closely equivalent to a switched or multiplexed combination of the original stereo signals — ignoring the pilot tone signal, which is used merely for synchronous regeneration of the 38kHz subcarrier (for any and all methods of decoding).

I'm almost there...

I don't know about you, but I think the only point that still isn't absolutely clear to me is that matter of crosstalk rejection. I *think* I understand the logic, but that flash of 'Yes — of course!' insight really still hasn't happened for me, despite the worthy efforts of Mr Freeman, Mr Metzenthen and even Mr Eilers...

I do have the feeling that it's all tied up with the fact that in the composite signal which is actually transmitted, the 38kHz samples of L-R signal are effectively 'filtered back' from a square waveform into half-sinewaves. I suspect that if we had the spectrum space to allow modulation and transmission of the full un-

Continued on page 114

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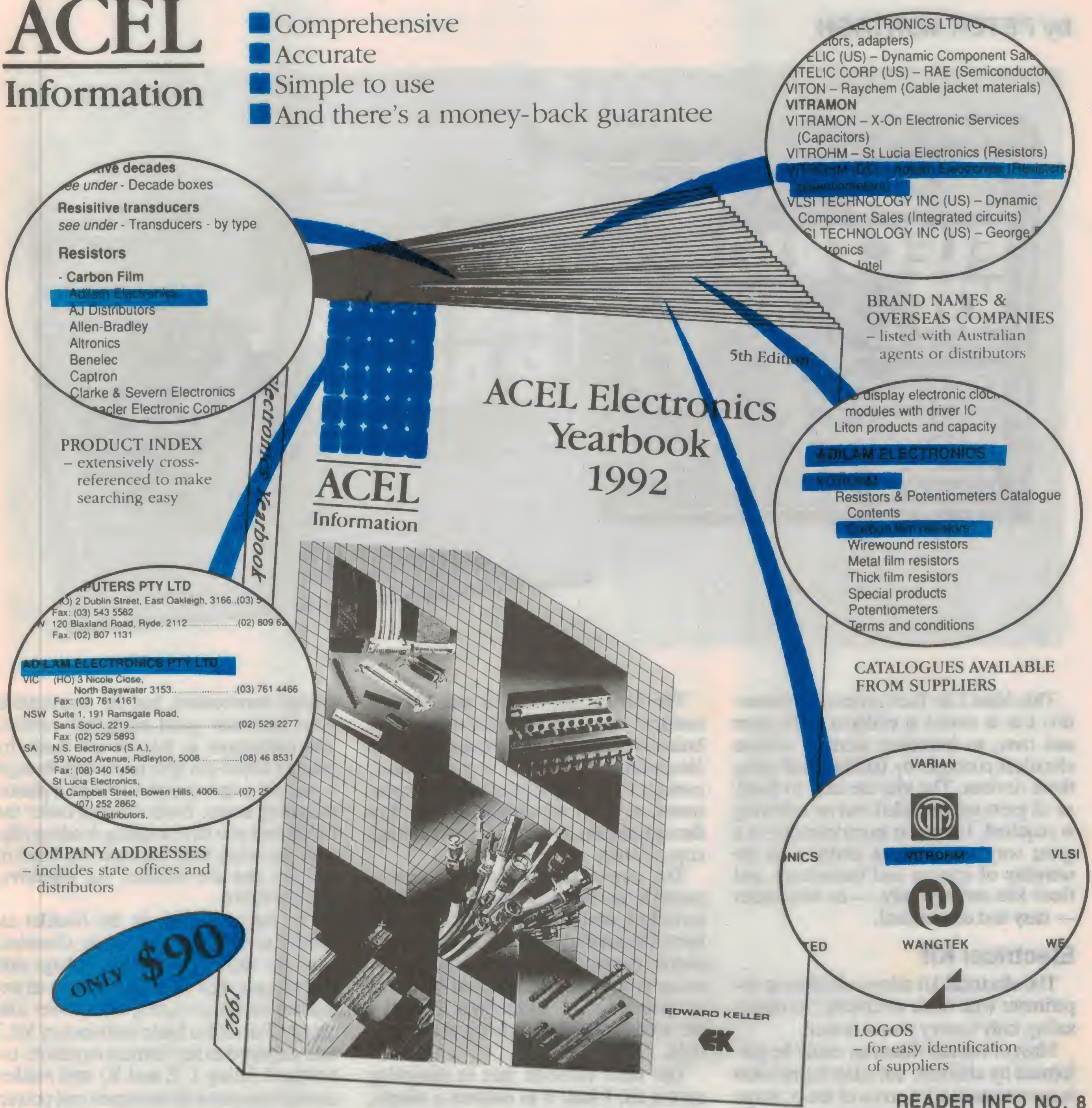

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LOW COST LEARNING KITS FROM DSE

Dick Smith Electronics has added two more kits to its Mini Lab Tech series. The first kit is designed to explain basic electricity through a series of simple experiments, while the second is a kit to build a crystal radio. The earlier kits were for an electric bell and an electric motor.

by PETER MURTAGH

This Mini Lab Tech series of construction kits is aimed at children eight years and over, to introduce them to various electrical concepts by building and using these devices. The kits are easy to build, as all parts are provided and no soldering is required. Hands-on experimenting is a great way to introduce children to the wonders of science and technology, and these kits are basically — as they claim — easy and educational.

Electrical Kit

The electrical kit allows children to experiment with basic electricity. To ensure safety, only battery power is used.

Most of the activities can easily be performed by children, but adult supervision is recommended for some of them. Some theory about basic electrical concepts is also included.

The kit includes lamps and holders, resistors and switches, plus a mounting board to interconnect the components. An interesting inclusion is a small plastic container for simple electrolysis experiments, to show that electricity can flow through certain liquids as well as through copper wires.

The experiments illustrate what is meant by an electrical circuit, the effect of switches, resistors and/or lamps connected in parallel and in series, and also a simple current meter. A flashing light is set up to send Morse Code, and an electrical puzzle called 'submarines' illustrates the need to complete a circuit to turn on a light.

The most difficult part in designing such a kit, I feel, is to produce a simple, cheap but effective means of connecting wires and components. It must be easy to change connections, but the connections must maintain good electrical contact. The connectors in this kit are made by passing a split-pin type paper clip through a washer, a spring and a hole in a plastic mounting board. Bend the legs under the board, and you have a spring-loading clip, with the wires held between the head of the pin and the washer. An effective, cheap solution.

The theory section in the booklet attempts to cover all the basic electrical concepts such as resistance, voltage and current (and their inter-relationship as expressed in Ohm's Law), and power and energy. For such a basic introductory kit, I was surprised to see formula equations introduced (using I, E and R) and mathematical treatment of resistance and power. Far too ambitious for eight year olds! The section on 'The Cost of Electricity' is bet-

ter, but I feel that this too could have been simplified.

The overseas origin of the kits shows through at times. For example, current flow through a circuit is illustrated by comparing it to hot water circulating through a home heating system. Water circulation through a swimming pool system would be more appropriate for Australia. And the text states that both the US and Australia operate off 110V — though this error is corrected in an addendum on a slip of paper.

The kit itself is excellent, but I would like to see the theory section in the accompanying booklet considerably simplified. Otherwise, this section just won't get read.

Crystal Radio

At first sight you would assume that this crystal radio shouldn't work, as there is no capacitor in the circuit. To select each radio frequency, a tuned circuit is needed, and such a circuit has a coil and capacitor. But, as the set does work, there is obviously sufficient intrinsic capacitance in the other components.

In fact, the tuning is done by varying the inductance of the coil, with a tuning ball making contact with each strand of wire in turn. This is the reverse to the traditional circuit, where the coil is fixed and the capacitance altered. This approach reduces the cost of the kit, as well as overcoming the difficulty in finding a parallel-plate tuning capacitor — they are in short supply these days.

Once you know what you are doing, the kit is easy to assemble. The coil takes a little time to wind, with about 100 turns of wire around a 5cm diameter cardboard former. The windings need to be wound carefully, close together and without overlap, as a small brass tuning wheel runs at right angles to the windings to make contact. The only other components are a diode and earphone, with two lengths of wires to connect the unit to earth and an aerial.

The variable inductance of the coil seemed to cover most of the AM spectrum — 2BL (about 700kHz) and 2CH (about 1200kHz) gave the clearest reception.

Because the discrimination of such a simple tuner is very poor, it was hard to identify stations at lower or higher frequencies than these. Several other stations could also be heard between these two frequencies, some better than others. The magic of radio reception, powered by the radio wave energy itself, never ceases to amaze — no matter what the quality of the reception.

The instructions optimistically suggest that the radio would work by holding the earth wire to a water tap, and holding the aerial lead in your other hand. To hear anything, I found a good earth and a long aerial were both necessary (my tests were done in the Sutherland area, about 20km to the south of Sydney, during the late afternoon).

The coil and other components are mounted on a plastic base, which you fold together and secure with tags through slots. I could not get the tags right into the slots without using a pair of pliers to grip them, and pulling hard. Fortunately, the plastic proved strong enough to withstand such treatment. But this part of the assembly would be too hard for the eight year olds and up, at whom the kit is aimed.

However, my major criticism of this kit again concerns the instruction booklet. I found the instructions far from clear, especially regarding the placement of wires and interconnection of components.

What you are told to do (in ambiguous English at times) differs from the colour photo on the box, which in turn differs from an outline diagram in the booklet. The wires enter different holes, and different numbers of bolts seem to be used. What is missing is a clearly labelled circuit diagram, with numbers and letters corresponding to those used on the holes on the plastic base.

Non-metric measurements are used, only sometimes with metric equivalents. A 3" measurement is converted at different times to 7cm and 7 1/2cm. A bigger problem arose when told to line up the eyelet on the tuning rod with one of the holes in the base. My pliers were needed to bend the tough metal to make this possible.

Another minor annoyance was an incorrect length of wire. You are told to unravel the last 4" of the twisted leads from the earphone, tie a knot to prevent further unravelling, and then thread the loose ends through their mounting holes. Only then do you find out that the wires won't reach their mounting screws!

Because the kit itself is good, it really seems a shame that it is spoilt by lack of clear assembly instructions and faulty manufacturing. But as it currently stands, I feel that many people would find it a source of frustration rather than enjoyment.

All four kits from the Mini Lab Tech series cost $16.95 each, and are available from Dick Smith Electronics. The DSE catalogue numbers for the new kits are K-1005 and K-1015. The kits are produced by the Tree of Knowledge, Kibbutz Yasur, Israel and the ones reviewed are its first English edition. ■

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by JIM ROWE

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THE SERVICEMAN

Heavy duty lateral thinking, and unexpected shocks and bangs in the deep North

This month we have a selection of reader's contributions. They come from as far apart as New Zealand and North Queensland, and illustrate some of the problems that come with the rural lifestyle. There are also a couple of short items from my own neck of the woods.

We open with a story that is unusual in two ways — it's about a commercial radio transmitter, and it's from P.L., in the 'Shaky Isles':

Little ever appears about the 'other side' of radio and television — from the technicians who keep the transmission systems working. Modern transmitters are duplicated, or have a large degree of redundancy, and are extremely reliable.

Not so a generation ago. Faults were far more frequent, and often resulted in a complete loss of transmission. Even so, quick diagnosis and resourcefulness are still called for today when faults occur. One event in my own experience is typical of the situations that regularly face transmission technicians, who as well as having a good knowledge of their equipment, must be able to diagnose faults quickly and accurately — and if necessary, improvise reliable emergency repairs. If a domestic service technician has a difficult problem, or is waiting for a spare part, he can put the equipment to one side until he has the right inspiration or the part arrives. At worst he has the wrath of one impatient customer, and possibly the service manager. But if one annoyed customer can be something to contend with, imagine the responsibility with thousands of viewers being bereft of their prime time programmes on the only TV channel in the area!

Lost programmes seem to bring out the worst in some members of the public, who can produce some incredibly unreasonable and vitriolic comments. Management too, becomes upset if valuable commercial time is interrupted. Believe me, such situations can concentrate the mind wondrously well!

Although many spares are carried at transmitter sites, not every contingency can be catered for, and some alternative remedy may be necessary.

Many problems involve power levels classed as electrical engineering, with voltages that can be in the thousands and currents measured in many amperes.

The story to be told here happened many years ago, soon after I had been promoted to head the technical department of the radio station in a provincial city. The 2kW transmitter was one of a large batch made by AWA in the late 1940's. Known locally as 'Black Twos', they were very good transmitters, some remaining in service until quite recently. However, they still had breakdowns from time to time.

One Sunday night, as I was about to go to bed, and right in the middle of the signoff theme, the transmitter failed. The duty technician and I travelled the 10km or so into the country to investigate.

We soon traced the problem to a transformer in a bias supply, which used a pair of mercury-vapour rectifiers to produce 180 volts at about 1/4 ampere. The faulty transformer had a centre-tapped 430 volt secondary winding and there was no spare in stock.

The nearest spare was held in the main store in Wellington, some 400 hilly

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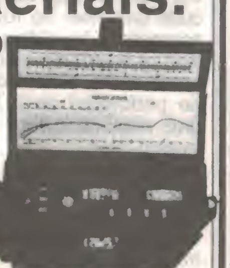

Ask your trade stockist for a copy of Jim Rowe's review, from E. A. June '90.

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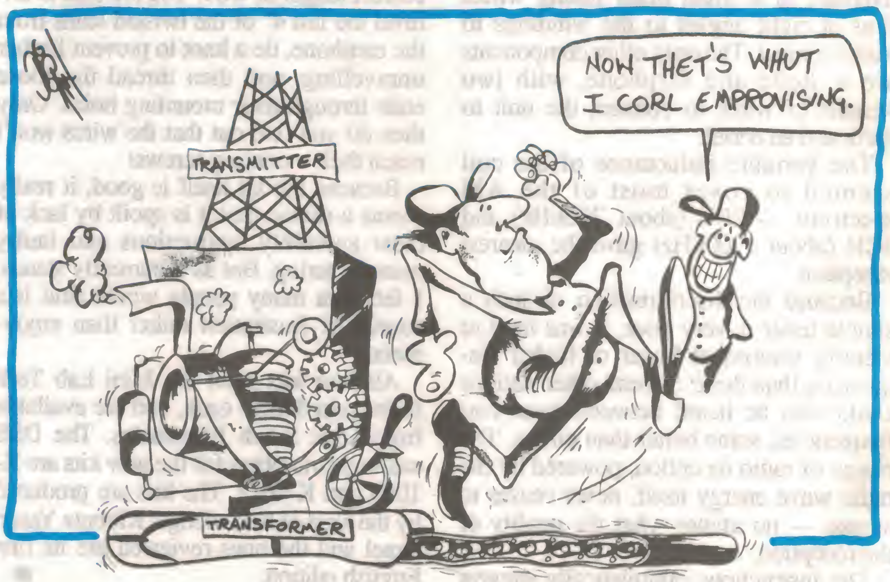


kilometres away, and it was midnight. There was no way that were going get a stock replacement installed by 6.00am, when a busy commercial programme was scheduled to start.

The earliest that a replacement could be arranged would be by air, late that morning. We had to find a substitute! But what?

Even a large receiver power transformer would have had an inadequate current rating and anyway, the voltage would have been too high. Clearly, some lateral thinking was necessary.

Fortunately, the rectifier filaments were supplied from a separate transformer, so all we needed was something that would supply 215 + 215 volts with a rating of at least 1/4 ampere. A mains isolating transformer had the right sort of voltage. The bias controls would have sufficient range to cope with the extra dozen or so volts, but we needed a biphase transformer. No problem — use TWO transformers!

There was a 1kW isolating transformer on site, and after a quick trip back to the studios we had a second. By correctly phasing the secondaries, we had our biphase supply to the rectifier anodes. After a small adjustment of some controls, we were back in business in time for the morning transmission, and the system worked perfectly until we were able to install a correct replacement.

A few years later, after semiconductor diodes had become available, the solution would have been much simpler. Using a bridge rectifier, a single transformer would have done the job nicely.

Thanks for that interesting reminiscence, P.L. It reminds me that this is only the third story on transmitters that I can recall seeing in these pages, in the 30 years I have been involved with the magazine. It seems that they come along once every decade! I hope we don't have to wait another 10 years for the next story on the subject.

By the way, there was one term used in P.L.'s story that might need explanation for younger readers. He used the word 'filament', in regard to the mercury-vapour rectifiers.

This term goes back to the days of battery powered radios, and refers to the thread-like heater that formed the cathode in those valves.

The introduction of indirectly heated valves for AC operation called for different terminology and the word 'heater' became the accepted term for the new technology. Because I am of a similar vintage to P.L., I too still think 'filament' — but usually check myself, and write 'heater'.

I suspect that P.L.'s mercury-vapour rectifiers had directly heated heaters, and so 'filaments' may have been the proper term. Yet 'wires', rather than 'filaments', might have been a more accurate description for the heaters in such heavy duty rectifiers.

Visitors zapped

Now for two amusing stories from far North Queensland. These are from our frequent correspondent, L.K. of Daintree, who always seems to come up with out-of-the-ordinary stories. His first story could well be about a new kind of intruder deterrent. It would certainly deter me!

My assistance was sought one morning by a farming friend, who entered the shop at the moment of most inconvenience — I'd just poured a cuppa! He opened the conversation by pointing out that he had come directly from home, had enjoyed a hearty breakfast after a good night's sleep, was not taking medication and finally indicated that the local amber fluid vendors were not yet open.

At this point I wasn't sure whether to offer congratulations or consolation, for I knew him as one who, to quote, 'enjoys the occasional quiet ale'!

He went on to suggest that in view of the above circumstances his problem must be given full credence. "The bloody front door knob of my house is giving people a shock", he uttered, "but what really confuses things is that it's a wooden door!"

My thoughts began to drift along the lines that the knob itself was probably metallic, and also the latch plate, which would no doubt be screwed to something. A suggestion that these screws may be a trifle long and had pierced the power cable to an external light fitting was brushed aside as he continued the tale.

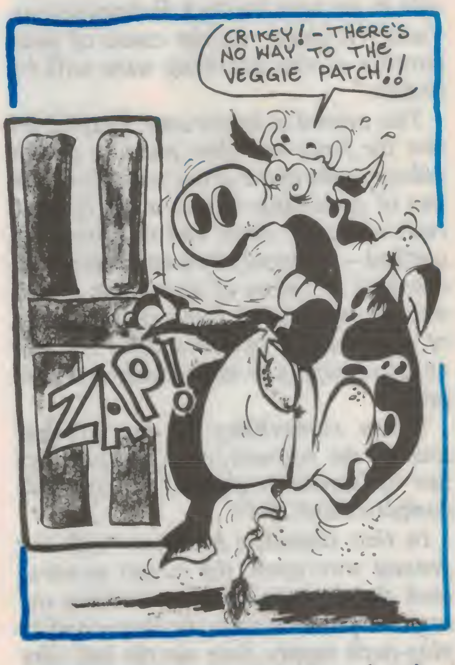
"It won't always do it, you know. I haven't been caught yet, but my wife has copped it twice and now the kids won't touch it. And don't tell me to get an electrician to check the wiring, because I've already done that." (So I didn't tell him.)

"He said there was nothing wrong with that side of it and even mentioned that static electricity might be the cause — until he got a belt while closing the door as he left. Now nothing I can do will entice him back again!"

We tossed the complaint around for a while longer, but I could not offer any further advice. My friend was obviously concerned, particularly if a member of the public were to be involved. Eventually, and reluctantly, I proposed that Mrs L.K. and I might take a drive into the country on the coming weekend, with time out to call in and see what could be done in laying the problem low. (Though at that stage I had not the slightest idea of where or how I would find the answer.)

The appointment was duly kept, with the front door already open on our arrival. A welcome emanated from within and after the usual preliminaries — during which I was informed that the problem had not made its presence known all day — we set out to inspect the aperture.

If the knob was being electrified, examination revealed that it could only happen when in contact with the latch plate, which in turn was screwed to the door frame. Although this frame was constructed of steel, there appeared to be no household wiring within reach, other than a light duty figure-eight cable coming from a bell-push, and running behind the metal frame before passing into the ceiling on the inside of the house.



Pressing the button brought a buzzing sound from somewhere at the rear of the building. Since this was the only wiring in the vicinity (and I'd exhausted any other avenues of thought) I suggested that we inspect the other end of the cable.

The wire emerged from the roof at the rear wall of the laundry and terminated in a buzzer mounted about two metres above the floor. A little below this was a power outlet, in which hung a plug-pack to supply the buzzer. It all looked very innocent.

Another somewhat stouter figure-eight cable also left the buzzer and disappeared through an adjacent ventilator, which I presumed was for a second bell-

push. On mentioning this to my host, he looked momentarily blank then his memory cleared.

"No", he said, "That's another story".

He explained that there was an electric fence installed at the back of the house, to keep cattle out of a vegetable garden. Some months earlier the battery which powered the fence had collapsed and, not having a convenient replacement, 'Number One Son' had conceived the idea of connecting it up to the plug-pack.

"It seemed like a good idea", he continued. "The little power unit goes night and day for nothing, so it might just as well run the fence".

Certainly it could easily handle the 100mA or so that a fence energizer required. But while he was telling me all this, the answers to the 'hot door knob' enigma began to fall into place.

"Take me to the fence installation", I said in my best Sherlock Holmes accent, "and I'll show you the cause of your trouble — the earthing wire will be broken."

This proved to be the case. I explained that the fence energizer puts out a high voltage spike to the active wires from one end of something akin to a car ignition coil, while the other end is thoroughly earthed — generally by being attached to a couple of pieces of water pipe driven well into the ground. It is a characteristic of most battery operated units that the negative supply is also attached at this point.

When something on the ground touches the hot wire, or it develops any low resistance to ground, the circuit is completed and ZAP!

In this situation however, with the ground wire open, the circuit to earth took the devious path back along the negative power lead to the buzzer and its plug-pack supply, then via the bell wire to where it lay against the metal front door frame. At this point, the insulation of the cable was totally inadequate in preventing an arc through to earth and so back to the fence.

Anybody holding the closed door knob at this instant was bound to help reduce the resistance to ground, especially if they were bare-footed as so many people are in this climate.

My friend explained that he didn't routinely check the connections, as he could always tell if the fence was working by the 'click' it radiated into the radio receiver.

I re-attached the severed wire — but suggested that, although it was now safe to close the door, it would be wise to operate the fence from a battery in future.

I suspect it was only the inability of the bell wire to withstand the voltage spike that has saved the plug-pack from destruction. It would surely have run a close second in the arc-over stakes!

So there you have it. A new way to repel unwanted visitors. It not only keeps cows out of the veggie patch, but keeps two-legged intruders away as well...

Nocturnal explosion

Now for L.K.'s second story, by an odd coincidence on the same general subject:

A cattle property in the dead of night might generally be considered a pretty peaceful place. But for one family, a violent explosion shattered the tranquility — sending the dog cowering for cover, setting the rooster crowing, and even waking up a neighbour a kilometre away.

It would seem the cause had remained a mystery, until I was requested to assess the merits of repairing an electric fence which had apparently ceased to function.

On opening the energiser, I was exposed to a sight that is hard to describe; the best I can say is that the unit looked a shambles. A large electrolytic capacitor had obviously disintegrated, and with such force that not only had the circuit board cracked through its full length, but even the robust plastic case was split for some 100mm!

I put the wreckage to one side, intending to investigate the malfunction at first opportunity — if only for my own knowledge, as there were quite a number of this brand sold in the region.

A few days later, with a spare couple of hours staring me in the face, I made a reasonable job of cleaning up the chaos.

Surprisingly, the only outward damage seemed to be the broken board, which wasn't too hard to patch. Next, I elected to fit a new electrolytic and see what did or didn't happen.

For those readers not familiar with energiser design, briefly a large capacitor is charged to a high voltage and at some predetermined point is rapidly discharged into the primary of a step up transformer, the secondary of which is connected to the insulated fence wires and earth. (Theoretically, the animals complete the circuit — once!)

This unit, being battery operated, also employed a ringing choke oscillator to generate the high voltage. (The operation of this circuit was ably described in EA for Oct 1990, on page 2 of the ETI supplement, and also on page 134 of the August 1991 issue.)

One unusual feature here was the use of a 25uF 300V electrolytic instead of the more usual paper or plastic type capacitors, such as those commonly found in single phase electric motors.

With 12V connected, I heard the oscillator spring into life; but the SCR failed to trigger. Suddenly the penny dropped, and I nearly spilled my cuppa in a frantic effort to hit the OFF button. A dangerous situation was staring me in the face, and I nearly didn't see it. If the SCR for any reason fails to fire and the oscillator is not checked, this type of circuit will continue to charge the capacitor, possibly beyond its maximum voltage rating.

I hooked a meter across it and tried again. Sure enough, the voltage was still rising when I turned it off, at 400V! No wonder the electrolytic turned it in with only a 300V limit. (Quite adequate under normal conditions where the thyristor is triggered at around 200V, but set up for trouble when the right fault rears its ugly head.)

With this particular repair I thought seriously about whether I should go any further. I had already spent considerable time on repairing the board and fitting a new capacitor.

Now I was faced with faultfinding the SCR circuitry. And the whole assembly was still liberally coated with the remains of the insides of the original capacitor!

It just didn't seem worthwhile, so I dropped the board in the bin. These energisers are moderately expensive, but there comes a time when the cost of repairs becomes just too high. Particularly so with a broken board coated with chemical goo from the burst electro...

Fortunately, it is usually only the oscillator that fails in this model, and this can be a quick and economical repair.

But I have decided to effect some form of modification (perhaps a higher voltage capacitor or a zener diode across it) to all future repairs to this model, as a precaution against any further Guy Fawkes type surprises for farmers or unwary technicians.

So there! Electric fences can cause all kinds of troubles, and not only of the electronic kind. Thanks L.K., I'm looking forward to your next contribution.

And now for a couple of short items from my own bailiwick. Both items were related to me by colleagues, who thought they might make interesting stories for these pages.

Neither is really long enough to make a feature story, but they are certainly interesting enough to deserve telling here.

Continued on page 68

Electronics Australia's latest publication:

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CIRCUIT SIMULATORS

AN INTRODUCTION

by JIM ROWE

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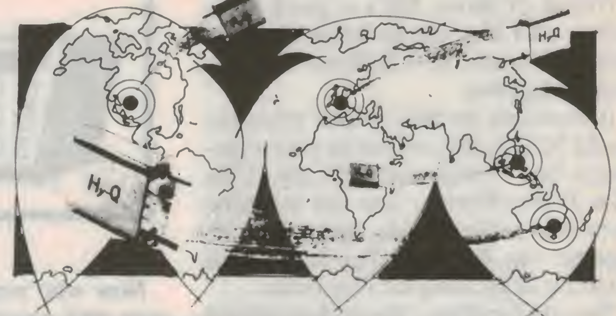

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Continued from page 66

VCR censorship

The first anecdote was passed to me by a friend of mine. He's a good technician and I've never known him to bend the truth, so I believe that this really happened.

It concerns an NEC video recorder, model 9033A, that refused to play a particular tape. It was a rented copy of the film *Pretty Woman*, and the machine went into rewind mode every time the cassette was inserted. They didn't even get as far as pressing the Play button.

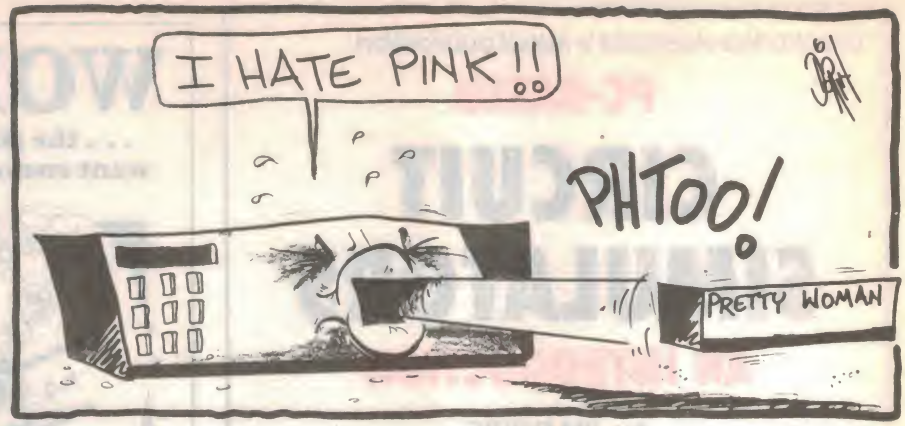
The odd thing was, the machine played other tapes perfectly, with not the slightest sign of protest. Yet over and over again, it would try to rewind *Pretty Woman*, even though the tape was already wound right back to the start.

My colleague eventually solved the problem, although he had no precedent to call on. The trouble was that the film was housed in a translucent pink cassette, rather that the more usual black plastic.

He determined that the light from the cassette housing lamp was reaching the end sensor, and telling the VCR's microprocessor that the tape was finished. It was, in fact, bypassing the light from the cassette lamp that usually signals end-of-tape, through the semi-transparent material of the cassette.

The cassette housing lamp only illuminates the interior of the machine to show the owner whether or not there is a tape inside.

By covering the housing lamp, the machine could be made to play *Pretty Woman* without any trouble. The fault could not occur in other brands and models that do not have the inspection light in the cassette well.



Now who would have thought that a sexy pink cassette could so confuse the poor machine? Or was it a Macho machine that didn't like the feminine colour scheme? All jokes aside, it's one of those obscure faults that can save you hours of time, once you know about it.

Hidden feature

The next item was related briefly during a phone call from a country colleague. I didn't believe it at first, but it has since been confirmed by Philips — so it must be true.

It seems that the problem arises on the Philips GR100 television chassis, used in a number of models from 14" to 20" screen size. The chassis is made in Singapore, but I don't know if that is significant. The customer complains that the set has lost its sound. Picture is perfect, but there's no sound at all.

Any technician who's not in the know might spend hours looking for the fault but he will find nothing. He may decide that the sound IC is faulty, and replacing it will restore normal sound. Unfortunately, the customer will be back in a week or two with exactly the same problem.

This could go on for months, until the technician decides to ask Philips for help. He will then be told that the set is not faulty but has gone into the 'hotel' mode, where the sound is muted and the

Continued on page 77

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Experimenting with Electronics

by PETER MURTAGH

Delay switch

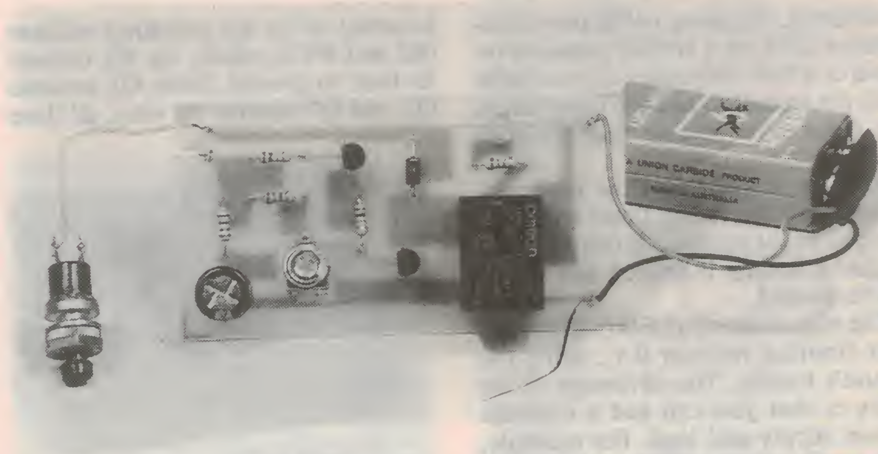
This month's circuit introduces two new features: how to use a relay to control other circuits, and also how to make use of a discharging capacitor to turn on a transistor for a pre-determined time. We have set up our circuit so that you press a pushbutton to turn a light on, then after a certain time — which you control — it turns itself off.

Quite often you wish to control some other action when a transistor turns on and off, and quite often this requires more current than the transistor is capable of providing. A common solution to this problem is to use the transistor to control a relay, and then use the relay contacts to carry the main current.

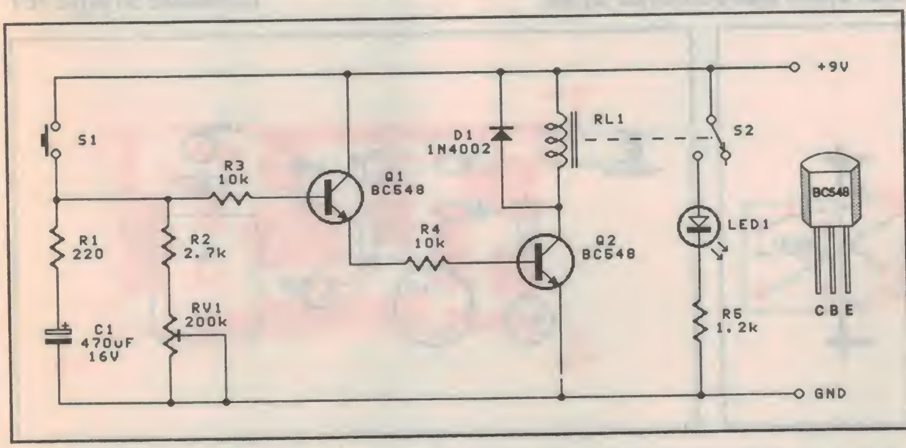
Special relays allow you to switch 240V in this way, but at this stage we recommend that you limit your experimenting to the safer low voltage.

You can use this circuit to turn on your siren, power up your flashing LEDs or simply turn on a light. Use your imagination, and think of something special that you can control this way — let us know if you think of anything original!

The time-delay aspect of this circuit means that you can automatically control how long your switching will occur. You press the pushbutton to quickly charge up a capacitor, which turns on the transistor (and the relay), and the time taken for the capacitor to discharge determines how long the transistor remains on. Two factors control this time: the size of the capacitor itself and the size of the resistor through which the charge leaks away — the bigger either of these, the longer the time. With the values shown on the schematic diagram, the time delay goes from approximately 4-200 seconds.



With the trim pot completely anticlockwise, the time is shortest. Rotate it clockwise and the time delay gradually increases.



Here's the schematic for this month's delay switch project. When pushbutton S1 is pressed, transistors Q1 and Q2 are turned on and energise relay RL1. At the same time, C1 is charged and this keeps everything on when S1 is released...

Construction

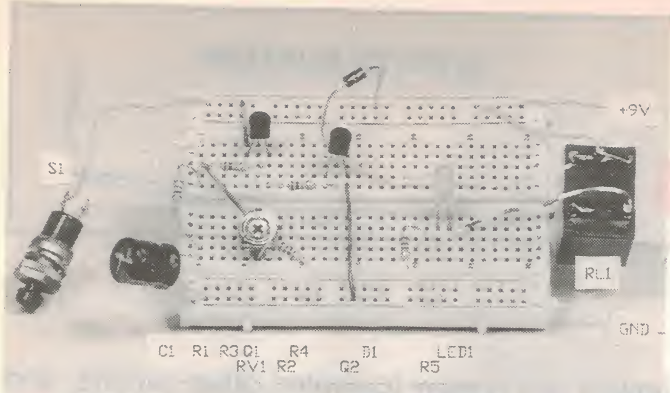
Mounting the relay will cause the greatest problem, unless you are using the PCB board. But if you are using the strip-board or breadboard approaches, the relay contact will not fit neatly into the holes. You will need to solder short leads onto the pins required (see the photo of the breadboard layout), or twist the ends of the wires around each pin to make a good contact.

Once the relay is connected, add the resistors, then the capacitor and diode, and finally the transistors.

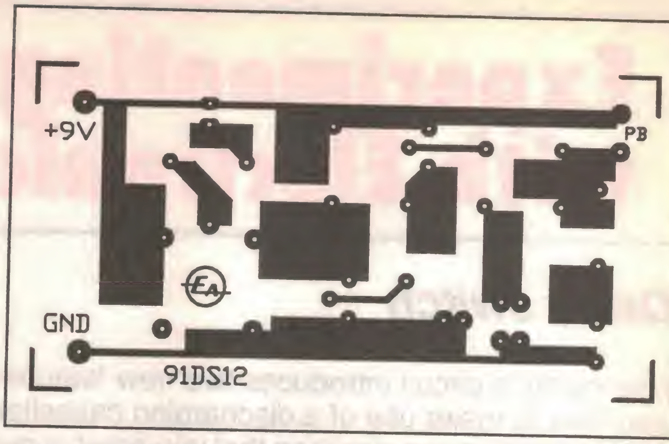
Only the resistors can be inserted either way around — make certain that the polarity is correct for all other components.

Changes

We have included the trimpot RV1 to allow the time delay to be changed easily. But if you want to alter the total interval, the 'time constant' of the circuit, then you can change the values of capacitor C1, resistor R2, or trimpot RV1. As a general rule, if you double the total resistance (R2 + RV1), *or* double the capacitance, then the time also will



This photo shows how the delay switch circuit is wired up on a prototyping board. The picture on the opposite page shows how the PCB version is wired up.



This is the PCB pattern, shown here actual size.

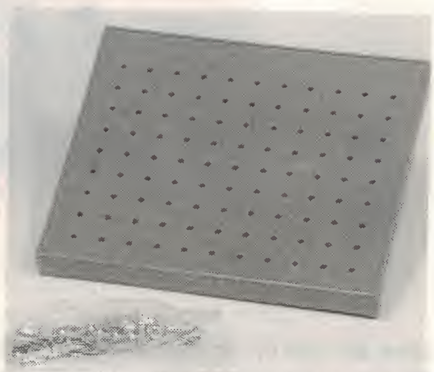
be doubled. Try using a 470k trimpot instead of 200k, or a 1000uF capacitor instead of 470uF. Of course, if you double both the resistance *and* the capacitance, the delay time will be four times as great.

Resistor R2 provides the minimum resistance (and hence time) when the trimpot is set to zero. It can be made larger or smaller if desired, but should not be omitted.

The relay turns on a LED (with its current-limiting resistor R5), using the circuit's battery. The advantage of the relay is that you can add a separate power supply and load. For example, you could switch a 40W car headlight, powered by a car battery. Such a light uses 3-4A, so our standard 9V battery could not hope to supply such a current. But the contacts of our cheap mini PCB relay are rated at 5A at 24V, so they are able to handle this current in a separate circuit.

How it works

Under normal conditions, relay RL1 is turned off. This is because transistor Q1 is turned off by the pull-down resistors (R2 and RV1), which, via R3, connect its base to ground. Since Q1 controls Q2, and Q2 controls the relay, all three



Here's another way to build your temporary circuits. The plastic mounting board is designed to take self-tapping screws. You twist the component leads around these screws, then tighten them to provide a good electrical contact. The mounting board, minus screws, is available from Dick Smith Electronics for $1.95.

are turned off. When you press the pushbutton S1, you immediately connect the base of Q1 to the +9V supply via R3. Current now flows through its base-emitter junction, and the transistor turns on. Resistor R3 limits the amount of current. Q1 turns on Q2, which turns on the relay, which then switches on the LED.

While the button is held down, current also flows to capacitor C1 and quickly charges it up. Resistor R1 slightly slows up this charging, but not enough to notice.

The actual delay circuit only begins to work when the button is released. Once this occurs, transistor Q1 will remain turned on as long as capacitor C1 retains sufficient charge.

This charge mainly leaks away through R2 and RV1, so the bigger these resistors, the longer it takes. (There is also some leakage through the transistors, due to the base current of Q1.)

Transistor Q2 turns on the relay because its collector-emitter current flows through the relay's coil. The magnetic

Continued on page 101

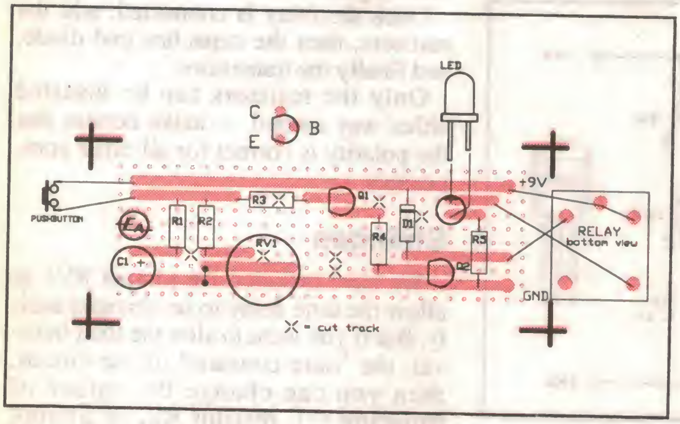


Fig.1: Wiring details for the delay switch if you elect to build it using a piece of Veroboard. Note that the relay cannot be easily mounted on the board.

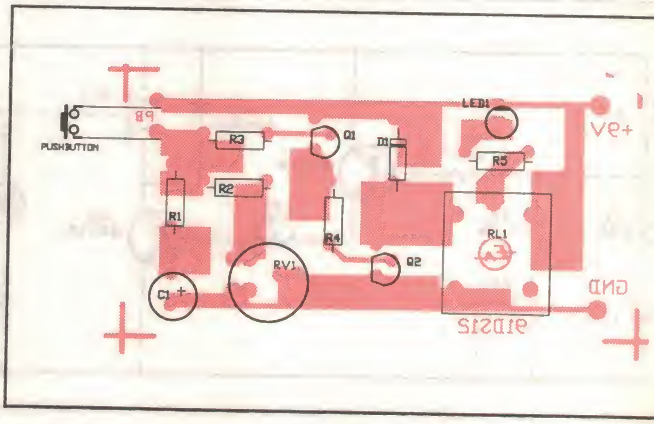
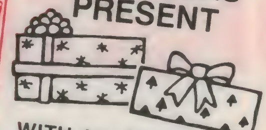


Fig.2: And here's the wiring overlay diagram for the PCB version of the delay switch. In this case, the relay will fit on the board providing you use the type recommended.

Don't forget to ask us for a CHRISTMAS PRESENT



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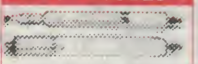
BIGGER LASER TUBES

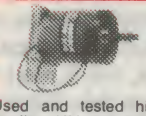


For the more serious applications we have some brand new, large 4mW and 10mW tubes. Both the tubes are of exceptional quality and would normally cost about three times the price indicated. Call us for a special deal for a tube and supply combination. The ridiculous tube only prices are:

4mW $155

10mW $386

12V SOLENOIDS



Used and tested high quality 12V solenoids. Suits 100's of electromechanical applications. The plunger is strong enough to be used as door latch. Very powerful, has a return spring and a travel of approximately 10mm.

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We have a limited stock of laser heads with an output of 0.5mW-1mW and their special mains operated power supplies. Both of these are professional quality brand new components, and to put them into action you will simply have them enclose the laser and the supply in a small box, and connect them to a mains supply via a fuse. LIMITED QUANTITY AT THE CLEARANCE PRICE OF:

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Not a complete kit, but just the absolute essentials: An unmarked 6032 IR tube, or a fibre optic tube with some blemishes, and a very compact power supply based on a military inverter. You get the tube, the power supply components, a circuit and basic instructions. A very compact viewer can be made by using these basic components. Excellent value! Call to check availability.

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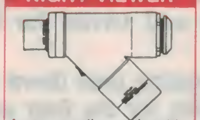
If you could never afford the fascination of owning a gas laser, have a close look at the "trio", in this "SPECIAL LASER INTRODUCTORY OFFER". The tubes are used but have plenty of life left in them. They are GUARANTEED! You get one small tube with an output of around 1mW, one high quality low divergence SIEMENS laser head with an output at about 3mW, and one of our reliable and efficient 12V UNIVERSAL LASER POWER SUPPLY KITS. A tube and the supply will easily slide into inexpensive 50mm SWV pipe, which makes for a compact self powered laser head. Casing is not supplied. Several of our customers reported that AT NIGHT, THE BEAM FROM THE SIEMENS WAS VISIBLE UP TO 4km AWAY! The kit comes with full instructions and it even includes a prewound transformer. The unlimited applications include laser pointers, surveying, optical experiments, medical field, holography, and fascinating laser displays. JUST IN TIME FOR THE FESTIVE SEASON. For a limited time only we are offering this "TRIO" COMBINATION (AS PER PICTURE) AT A TOTAL PRICE OF: $149

What's more a special Christmas offer: FREE CERTIFIED PACK AND POST ON THIS TRIO! The free P&P offer applies till the end of 1991. Don't require the bigger tube? The remaining "Duo" can be bought for **$99!**

INFRA RED NIGHT VIEWER



A very small complete kit • Includes both an adjustable lens and an eyepiece • The matching tubes, lenses and eyepieces were removed from new German night vision equipment • Simple construction: Instructions provided • For a limited time only the kit is supplied with a high quality military inverter: Draws only 25mA from the 9V battery • IR illumination is required in the dark, and good ranges are possible with just medium powered focussable torches, fitted with an IR filter • You would normally pay over $3000 for a view like this!

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ONLY $329

E.A. Oct. 1991

Includes the IR tube, lens eyepiece, electronics kit and the case kit: KIT No. IRNW5. 75mm round IR plastic filter: $16.

1 WATT–6V SOLAR PANEL

Hobbyists delight! One of these panels will fully charge a 6V-500mA HR nicad battery pack in about 4 hours! You can also connect as many of these panels in series or parallel to produce the voltage and current required.

DIMENSIONS: 200mm X 200mm

Voc: 8V (max) 10V

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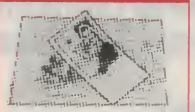
IR LASER DIODES



Experimenters delight! A brand new 5mW 780nM-820nM infra red laser diodes supplied with a collimating lens, heatsink, laser diode data, a suitable driver circuit and the components for this circuit. Visible in low light. Excellent for IR sights, data links, high quality audio links, security perimeter protection, laset listening devices, etc.

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For all the above components!

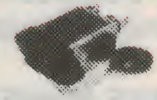
We provide a circuit for a laser listening system which relies on window vibrations, produced by sounds in a room. Works at good distances! The whole kit may be available when this magazine is published. Best give us a call.

VISIBLE LASER DIODE PIONTER AT A SPECIAL PRICE

Based on a "state of the art" 3mW visible re laser diode, and a matching heatsink/collimator assembly. The circuit even has provision for digital switching. Use them for pointers, sights, communications, security, etc. This kit includes the laser diode, collimator, PCB and components, and all the casing: Everything you need to make a complete pointer! PRICE IS REDUCED BY OVER 20%!

$179 + $5 Cert P&P

MAINS FILTERS



A complete mains filter employing two inductors and three capacitors fitted in a metal shielded IEC socket. We include a 40 joule varistor with each filter!

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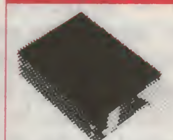
15kV EHT POWER SUPPLY



Used but guaranteed regulated supply. Needs a DC supply of 19-28V for full 15kV 500uA output. That's about 7.5W of EHT energy! Great for all sorts of experimentation. Will work with reduced input voltage as low as 3V but output is reduced in voltage and current capacity.

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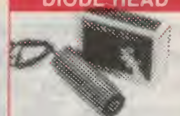
VISIBLE LASER DIODE HEAD



A small 3mW 670nM visible laser diode head. Just connect it to a battery via a switch. Produces a well collimated beam. You could pay three times our price for a laser pointer or gun sight that uses a similar head.

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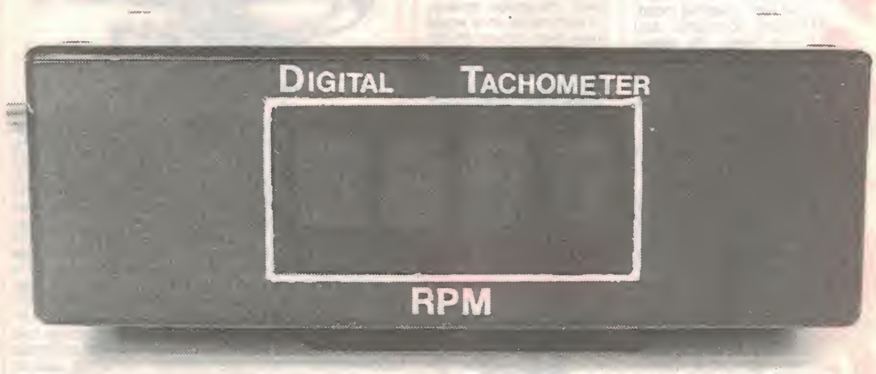
Construction Project:

DIGITAL TACHO

If you've already built some (or all!) of our recently published digital automotive projects, this new tachometer will really complement the set. It reads engine RPM directly, giving a readout from 0 to 9990. Because it takes its input from the distributor points, there is no sensor required and calibration requires only one simple adjustment that can be performed in the workshop.

by JEFF MONEGAL



A tachometer is an obvious addition to the other digital automotive projects we've published over the last 12 months. We've also made it look the same, so an 'all digital' dashboard is becoming a reality.

The tacho displays engine RPM on a 4-digit display with a resolution of 10rpm — achieved by setting the 'zeroes' display to permanently read zero. This reduces display flicker at low revs and also helps to reduce the required gating time. In fact, a feature of this project is the short gating time, resulting in fast updating of the display.

In its simplest form, a digital tachometer is a frequency counter with a gating time of one minute, to give an output proportional to revolutions per minute. This assumes one pulse per revolution from the engine being monitored. And having to wait a minute before the display is updated is obviously far too long.

For a six cylinder engine, the distributor points open and close three times per revolution, giving three pulses each revolution. The points open and close twice per revolution for a four cylinder engine and four times for an eight cylinder engine. For a six cylinder engine, it works out that for 1000rpm, there are 50 operations of the points per second. To cause the display to read 1000 requires a gating time of 1000/50, or 20 seconds. However this gating time is still too long.

By using a resolution of 10rpm, the gating time is reduced by a factor of 10, giving a gating time of two seconds, which is really still excessive. To get the gating time down even further, the incoming pulses effectively need to be *multiplied*, to increase the number of pulses per second that are fed to the frequency counter section.

In this project, that's exactly what we do — multiply the pulse frequency, by a factor which depends on the number of cylinders — and is selected by a link on the PC board.

Depending on the setting of this link, the multiplication factor is four times for a 4-cylinder engine, three times for a 6-cylinder engine and twice for 8-cylinders.

This brings the gating time down to around 0.75 seconds for the four and eight cylinder engines, and to 0.67 seconds for a six cylinder engine. In practice this gives a good update speed for the display.

To provide the multiplication, a CMOS phase-locked loop IC type 4046 is used. This IC is ideal for the purpose and is readily available. So, in principle, the final tacho is nothing more than a frequency counter with a front-end pulse multiplier.

Like all of our previous automotive projects, the display is dimmed automatically when the car headlights are turned on. This ensures the display is not distracting during night driving.

Calibration is carried out on the workbench, using 50Hz as the input frequency. Once the unit is calibrated at one speed, the rest must be correct — a factor that cannot be guaranteed with an analog tachometer, as the meter movement may have linearity errors.

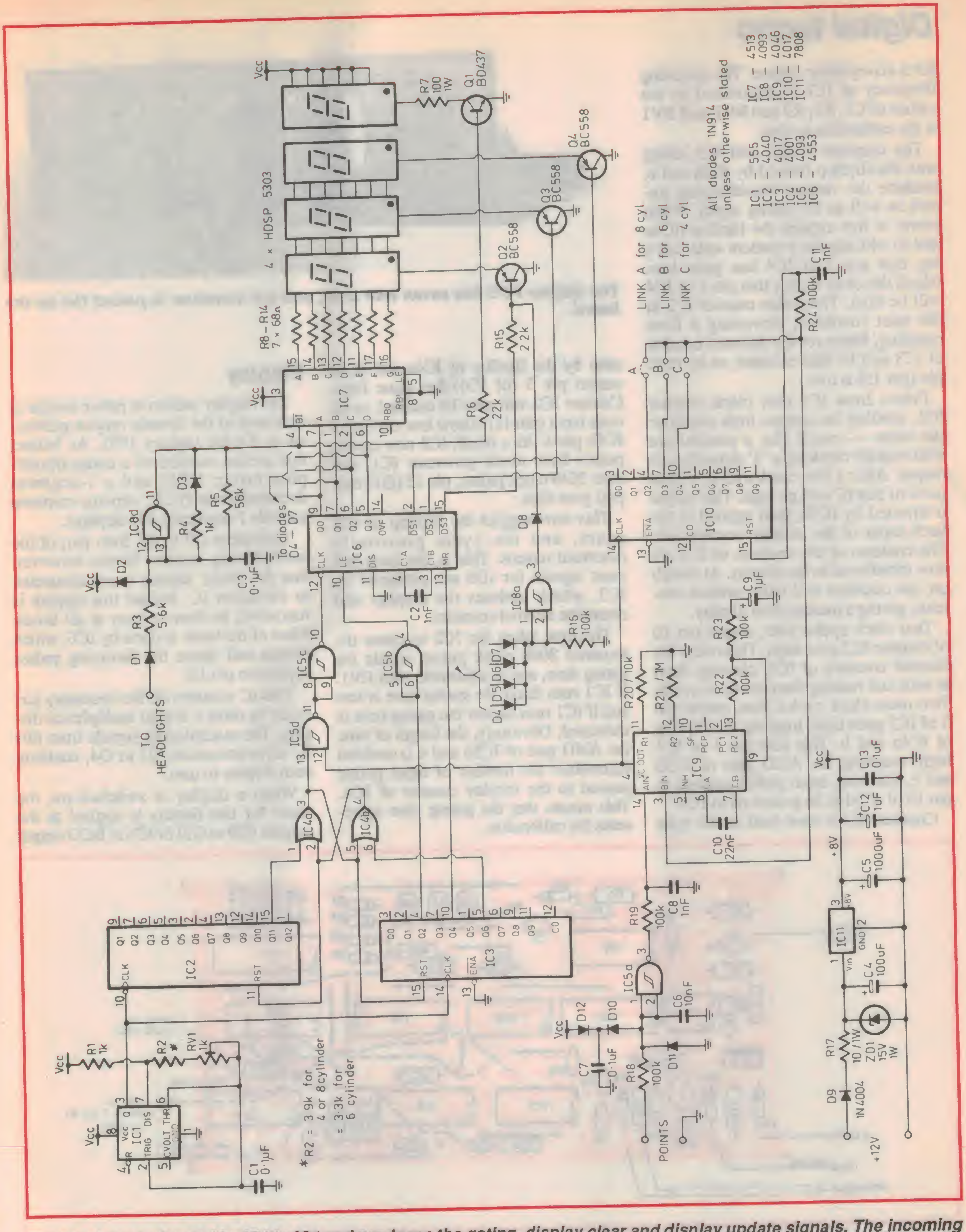
As we've already pointed out, the input signal to the tacho is taken from the distributor points, so installation is simply a matter of running wires to various points in the vehicle. So our digital tacho is simple to build, calibrate and install.

Now to the technical details...

How it works

The circuit is best described by breaking it into several blocks: the pulse input conditioning block and pulse multiplier, the timebase and the counter/display block. The power supply can be considered as a separate block as well. Because the circuit is essentially a frequency counter, we'll start with the timebase section, as this block provides the various timing and housekeeping signals required in any frequency counter.

The oscillator for the timebase is IC1, a 555 timer connected as an astable. The frequency of oscillation is adjusted with RV1 and to allow the best adjustment, timing resistor R2 should be 3.9k for a four- or eight-cylinder engine, and 3.3k



The timebase is formed by IC1 to IC4 and produces the gating, display clear and display update signals. The incoming pulses are multiplied by the PLL of IC9, which works in conjunction with IC10. The display is multiplexed, driven by IC6 and IC7.

for a six-cylinder engine. The operating frequency of IC1 is determined by the values of C1, R1, R2 and RV1, and RV1 is the calibration control.

The counters of IC2 and IC3, along with the flipflop formed by IC4a and b, produce the various housekeeping signals as well as the gating signal. When power is first applied the flipflop (IC4a and b) will assume a random state. Let's say that pin 3 of IC4 has gone low, which therefore means that pin 4 of IC4 will be high. This holds counter IC2 in the reset condition, preventing it from counting. However the Johnson counter of IC3 *will* be able to count, as its reset pin (pin 15) is low.

Pulses from IC1 now clock counter IC3, sending its outputs high one after the other — much like a parallel-out shift register clocking a '1' through each output. After a few clock cycles, output pin 4 of this IC will go high. This output is inverted by IC5b, then applied to the latch input of the display counter IC6. The contents of the counters of IC6 are now transferred to the display. At switch on, the counters will have random contents, giving a meaningless display.

Two clock cycles later, output pin 10 of counter IC3 goes high. This resets the internal counters of IC6, clearing them to zero and making them ready to count. Two more clock cycles later, output pin 5 of IC3 goes high, toggling the flipflop of IC4a and b. This sets pin 3 of IC4 high, enabling the AND gate of IC5d and c, allowing input pulses applied to pin 12 of IC5d to be passed on to IC6.

Counter IC3 is now held in the reset state by the flipflop of IC4a and b, as output pin 3 (of IC4) has gone high. Counter IC2 will now be enabled, as its reset input (pin 11) is now low, driven by IC4b pin 4. As a result, IC2 now counts pulses from clock generator IC1, and after 2048 clock pulses, pin 15 (Q11 output) goes high.

This now toggles the flipflop of IC4 again, and the cycle previously described repeats. That is, the latch and reset signals for IC6 are produced by IC3, which updates the display and clears the internal counters.

The time taken for IC2 to count the required 2048 clock pulses equals the gating time, and is adjustable with RV1. If IC1 runs faster the gating time is less and if IC1 runs slower the gating time is increased. Obviously, the length of time the AND gate of IC5d and c is enabled determines the number of input pulses passed to the display counter of IC6. This means that the gating time represents the calibration.

The display PCB has seven wire links, and the transistor is placed flat on the board.

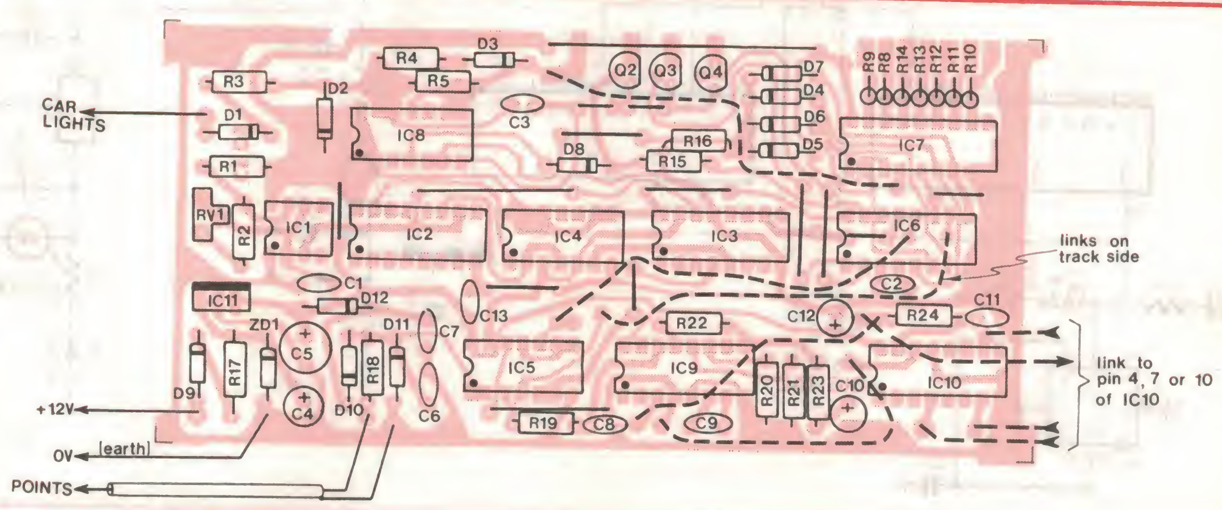
Display

The display section is rather similar to that used in the Speedo project published in *EA* for January 1991. As before, this section consists of a counter/multiplex driver (IC6) and a 7-segment decoder/driver (IC7), driving common cathode 7-segment LED displays.

Transistors Q2 to Q4 form part of the multiplexing system. Notice however, that the 'zeros' display is not connected to the driver IC. Instead this display is hardwired to show a zero at all times. Most of the work is done by IC6, which counts and stores the incoming pulses applied to pin 12.

This IC contains all the necessary circuitry to drive a 3-digit multiplexed display. The multiplexing signals from this IC drive transistors Q2 to Q4, enabling each display in turn.

When a display is switched on, the count for that display is applied to the outputs (Q0 to Q3) of IC6.is BCD output



The layout of the main PCB. The links fitted to the track side of the board are shown dotted. Remember to fit the links on the component side of the board first, as one of these is under IC6.

is decoded by IC7 and applied to the three displays.

As in the speedo project, leading zero blanking is used, although here this is applied only to the 'thousands' display. Most engines idle above 100rpm, so blanking the 'hundreds' display is unnecessary. Diodes D4 to D7 along with R16 form an OR gate, and the anodes of the diodes are connected to the data outputs of IC6. When the BCD data from IC6 is '0000', all four diodes will be reverse biased. Thus, R16 will pull the input of IC8b low, sending its output high. This forward biases D8, which holds Q2 off — turning off the 'thousands' display.

Like the speedo and the tripmeter projects, display dimming is provided. However, a difference here is that the 'zeroes' display also has to be dimmed, even though it is not connected to the driver IC. This is achieved with Q1, which connects to the dimming circuit around IC8d.

The dimming circuit is otherwise identical to that previously used, in which an oscillator formed by IC8d is used to modulate the display intensity through pin 4 of IC7.

When the car lights are off, the timing components for the oscillator are R4, R5 and C3 — giving an output that is high some 56 times longer than its low time, due to the ratio of R4 and R5. Thus the displays are virtually always on.

When 12V is applied to D1, the output waveform has high and low times that are virtually equal as R3 is effectively placed in parallel with R5. This gives reduced brightness of the displays, as they are now off for a greater length of time.

The value of R3 therefore determines the level of brightness under these conditions. If you want to reduce the display brightness further, use a lower value for R3. The output of IC8d also drives the base of Q1, which gives the same level of brightness change to the 'zeroes' display as IC7 gives to the other displays.

Pulse conditioning

The input signal to the circuit is taken from the engine's distributor points. This is essentially a 12V pulse, and it's conditioned and squared up by the Schmitt trigger gate IC5a, after filtering by R18 and C6. Diodes D10 and D11 clip the signal so that it doesn't exceed the supply voltage of the circuit — otherwise IC5 could be destroyed, due to overvoltage at its input. The output of IC5a is connected to the input of the phase-locked loop IC (IC9) via the low-pass RC filter comprising R19 and C8.

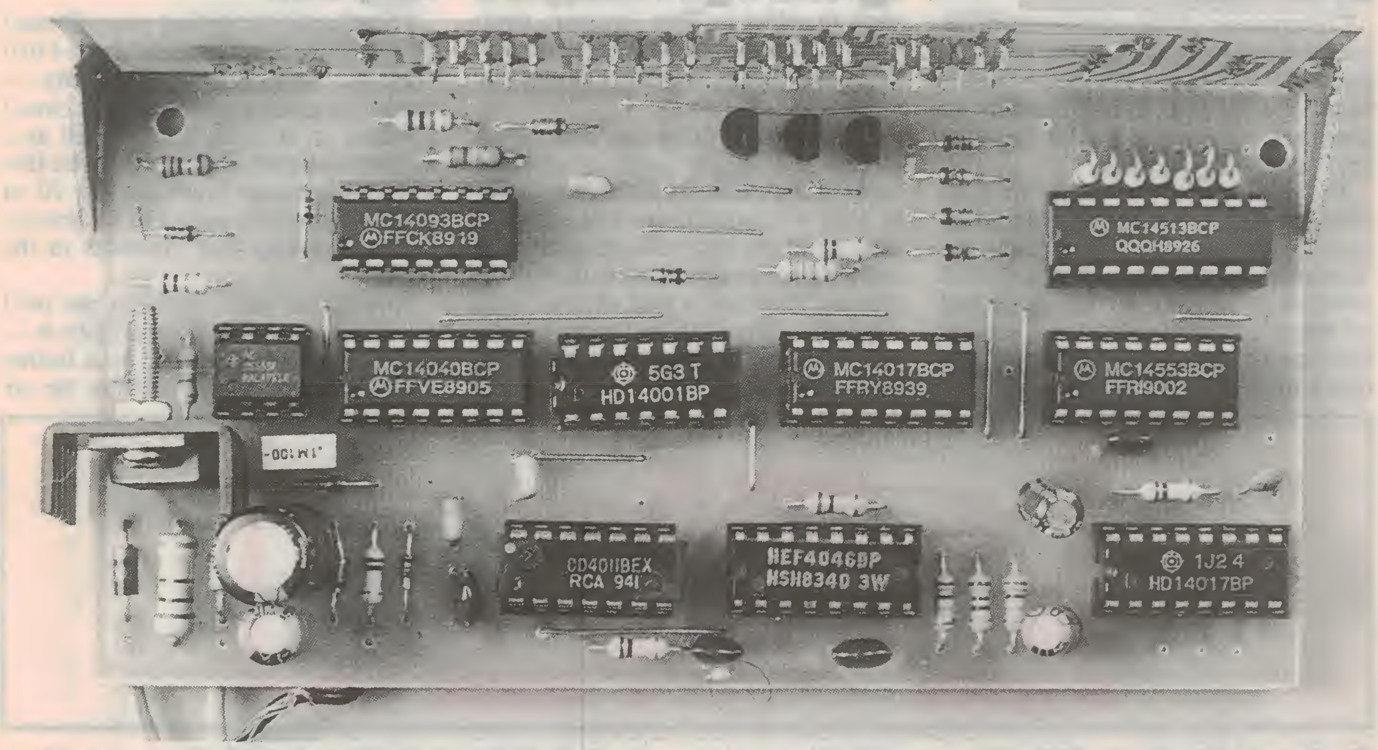
The multiplier section consists of the phase-locked loop (PLL) IC9 and the Johnson counter IC10. The function of this circuit is to produce an output that is a multiplication of the input pulse frequency.

The PLL contains a voltage-controlled oscillator (VCO) and a phase comparator. One input of the phase comparator (pin 14) is connected to the RC filter of R19 and C8, while the other input (pin 3) is fed from the output of counter IC10. The output of the comparator (pin 13) drives a lag-lead filter network (R22, R23 and C9), the output of which is fed back to the input of the VCO (pin 9, IC9).

In operation, the VCO adjusts its frequency so that its output (pin 4), after division by IC10, is the same as the input frequency at pin 14. In other words, if IC10 divides by two, the output frequency of the PLL will be twice the pulse input frequency applied to pin 14; and so on.

Counter IC10 can be set to divide by two, three or four for an 8-, 6- or 4-cylinder engine respectively. This is achieved by the feedback taken from the network of R24 and C11 back to the reset input of IC10 (pin 15). This network is required to provide a short delay, to ensure that IC10 is reset when the selected count is reached.

The output of the PLL clocks the counter, and the counter outputs are



This shot shows the complete assembly of the tacho. A small heatsink needs to be fitted to the regulator IC.

pulsed high, one after the other as described for IC3. A link is used to select the required output from IC10, and when that output goes high, the counter is reset — ready to repeat the sequence. The selected output is also connected to the PLL, as described above.

Power supply

Power for the circuit is provided by IC11, an 8V three-terminal regulator IC. Diode D9 protects against polarity reversal and R17, in conjunction with ZD1 protects the regulator IC against overvoltage. Filtering of the 12V DC input is provided by C4.

The output of the regulator is filtered by C5, a 1000uF capacitor. You might think that this is a rather high value for a filter capacitor connected to the output of a voltage regulator and that it should be placed on the input side. In this application, a 1000uF capacitor is much more efficent on the low voltage side of the regulator because it only has to filter the voltage supplied to the circuit.

Incidentally, the load presented by the circuit is rather erratic — depending on the displayed numbers. If C5 was placed on the input side of the regulator then it would also be trying to filter the voltage to the rest of the vehicle's electrical system.

Construction

Construction of the unit is relatively straightforward, and like the previous projects involves two PCBs: the display board and the main board. Start by inspecting both boards, in case there are any manufacturing errors.

The display PCB has seven links, all mounted on the component side of the board. Make sure the links beneath the 'hundreds' display are not touching each other, as they mount at right angles and are rather close to each other. I suggest that you fit sleeving over the link that runs horizontally, just to make sure.

Next fit and solder the two resistors, followed by the transistor. The transistor needs to be laid flat against the board, with the metal side facing out. Then mount the four displays, with their decimal point towards the bottom of the board. The main PCB is fairly crowded and care must be taken when soldering. Because we've opted for a single-sided board, there are quite a few links required. Start with the 15 wire links fitted to the component side of the board. Note that one of these is under IC6. There are also six insulated wire links fitted to the track side of the board, which can be fitted later.

Solder all resistors, capacitors, diodes and transistors, taking care with the polarised components. If you plan to use IC sockets (which we recommend) fit these next. Finally solder the regulator in place and attach a small heatsink as shown in the photos.

The calibration pot can now be fitted, followed by the insulated wire links on the track side of the board (if not already fitted). Take a few moments to check your soldering, looking particularly for solder bridges and other soldering errors.

The display board can now be attached to the main board. Align the boards together, mutually at right angles, and solder the tracks from each board. The display board will need to extend about 3mm below the track side of the main board, to give a suitable area of track to solder to. Two 'gussets', made from PCB scraps should be soldered at both ends of the assembly to provide mechanical strength.

The external wiring can now be attached. We used a length of shielded cable to connect to the distributor points, to help minimise noise pick up. The earth braid can be connected at the PCB and need not be connected to the vehicle chassis. There are a total of four wires required — the +12V and earth wires, a wire to the car headlights and the lead to the points.

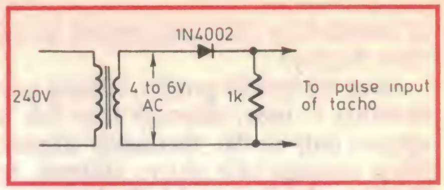


Fig.1: This simple circuit is all you need to calibrate the tacho. Connect it to the pulse input of the tacho and adjust the calibration control as described in the text.

Testing

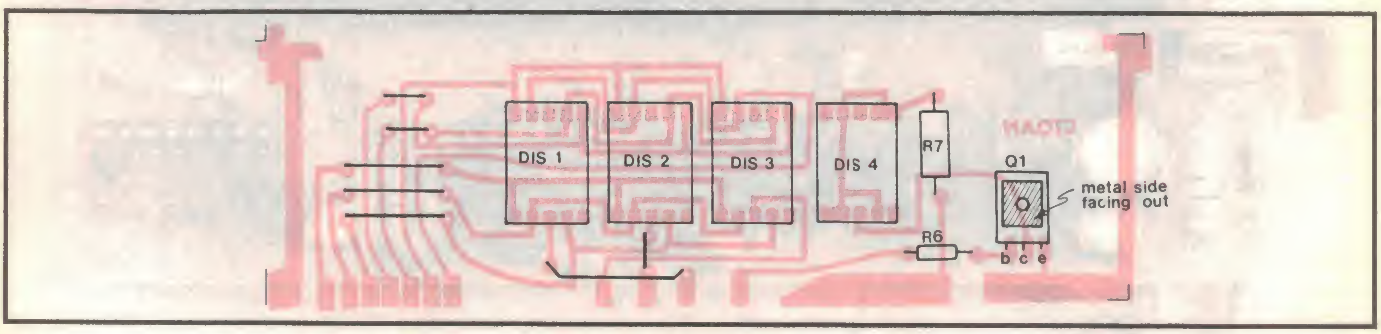
When you are satisfied that the assembly is correct, it can be tested on the workbench. Connect the unit to a 12 volt DC supply, from either a power supply or 12V battery. The remaining wires need not be connected at this stage.

When power is first applied, the display should show a random number less than 1000. Rotate the calibration pot and check that the display value varies with the pot setting. Then connect the 'lights' wire to the 12V supply and confirm that the display dims as described before. If all is well, the unit can be calibrated. Otherwise, switch off the power and look for the fault(s). The usual problems are assembly errors, such as components fitted the wrong way round, soldering errors and so on. Like all projects designed by CTOAN, if you can't find the problem, the company will fix it for you (see end of article for details).

Calibration

To calibrate the project you will need a low voltage transformer of about 4 to 6 volts AC, a diode and a 1k resistor — connected as shown in Fig.1. This circuit provides an accurate 50Hz signal as a calibration signal. Connect the wire link to the 4-cylinder position (pin 10 of IC10). Connect the output of the test circuit to the lead that connects to the points.

Now adjust the calibration pot until the display reads 1500. And that's it — the unit is now calibrated. As a further check, connect the wire link to the six



The layout of the display PCB. After assembly, this board connects via its PCB tracks to the main PCB. Fit gussets at both ends to give mechanical strength to the assembly.

PARTS LIST

Resistors

All 1/4W, 5% unless otherwise stated:

R1,4	1k
R2	3.3k or 3.9k (see text)
R3	5.6k
R5	56k
R6	22k
R7	100 ohm, 1W
R8-14	68 ohm
R15	2.2k
R16,18,19,R22,23,24	100k
R17	10 ohm, 1W
R20	10k
R21	1M
RV1	1k trimpot

Capacitors

C1	0.1uF polyester
C3,7,13	0.1uF monolithic
C2,8,11	1nF polyester
C4	100uF 16V electrolytic
C5	1000uF 16V electrolytic
C6	10nF polyester
C9,12	1uF 16V electrolytic
C10	22nF polyester

Semiconductors

D1-8,10-12	1N914 signal diode
D9	1N4001 1A diode
ZD1	15V 1W zener diode
Q1	BD437 NPN transistor
Q2-4	BC558 PNP transistor
IC1	555 timer
IC2	4040 counter
IC3,10	4017 decade counter
IC4	4001 quad NOR gate
IC5,8	4093 Schmitt NAND
IC6	4553 3-digit counter
IC7	4513 display driver
IC9	4046 phase-locked loop
IC11	7808 8V regulator

Displays

HDSP5303 common-cathode displays

Miscellaneous

PCB 130mm x 115mm coded CEDS;
plastic case 50 x 95 x 155mm;
strip of red perspex;
hookup wire, solder, nuts, bolts.

A kit of parts for this project is available from CTOAN Electronics for $44.95, which includes the PCB and all components. It does not include the case. Add $3.50 for post and packing. Fully built and tested units can be purchased for $69.95, plus $4 P&P.

CTOAN Electronics also offers a full backup and repair service for the kit. Cost for repair is $20, plus $4 P&P. Only kits built as described in this article can be accepted for repair. To order, write or phone:

CTOAN Electronics
PO Box 33,
Condell Park, NSW 2200
Phone (02) 708 3763

Copyright for the PCB artwork of this project is retained by CTOAN Electronics.

and eight cylinder positions and confirm that the display reads 1000 and 750 respectively. With the calibration done, you can swing over the wire link to the correct position for your vehicle's engine.

Installation

It remains to fit the assembly into a suitable case and to install it in the vehicle. We used a jiffy box as the case, with a cutout in one side for the displays. A piece of red translucent plastic should be fitted over the displays to make them easier to read. The plastic can be glued to the inside of the case with silicone glue (or similar).

An exit hole for the wires is also required, drilled in the rear of the case. All wires can exit from the same hole. The assembly is supported with two screws at the display edge of the main PCB. Drill holes in the bottom of the case, then fit the screws to the case by screwing a nut to each. Then place the assembly onto the screws and fit nuts onto the screws to hold the assembly in place.

As for any automotive installation, use wire with relatively thick insulation for best protection and fit rubber grommets to holes for the wires to pass through. It is also a good idea to form the wires into a loom, either taped with PVC tape or bound with nylon straps.

The unit requires a single 12V supply that turns off with the ignition. This can usually be obtained from the vehicle's fuse box. Attach the earth wire to a suitable point on the vehicle chassis, taking the usual precautions to ensure it is a good connection. To allow the dimming circuit to work, a connection is required to the vehicle's lighting circuit, usually the headlights. You may be able to pick this up at the fuse box, otherwise run the wire to either of the headlights and connect it at the lamp socket.

As already described, a length of shielded cable can be used to connect the unit to the distributor points. Earth the cable at a suitable point on the main PCB and connect the centre core of the cable to the distributor points terminal.

Then mount the unit so it is out of direct sunlight, to allow the display to be clearly visible during the day.

Because there are no switches or controls, the unit can be fitted anywhere on the dashboard — providing it can be seen by the driver, of course! ■

THE SERVICEMAN

Continued from page 68

control is rendered ineffective.

It seems that the feature is used in large multi-roomed hotels to curtail the activities of anti-social guests. I wasn't told how the hotel is able to silence the noisy set, but the effectiveness of the system relies on the guest not knowing how to overcome the control.

The cure is dead simple once you know how. All you need to do is to select Channel 38, then press 'Store' and 'Control + ' together. This will unlatch the set from 'hotel' mode, and restore full control over the volume.

There is nothing about this feature in the User Manual, nor anything in the Service Manual. However, Philips assures me that an explanatory leaflet is packed with every set on delivery.

But how many customers manage to retain the warranty papers for more than a few months. User manuals last an even shorter time. So what are the chances that they'll keep a loose leaflet with a normally obscure instruction?

It seems that the problem is triggered by mains-borne interference, which can simulate the master control pulse. Unfortunately for owners in areas with noisy mains, this could become a recurring problem.

It could also be a goldmine for unscrupulous servicemen. I hope that none of my readers would consider keeping the secret from the unfortunate owners.

That's all for this month. Join us again next time for more intriguing tales — all of them true! — from the Serviceman's workshop. ■

Fault of the Month

National M6 chassis

SYMPTOM: Overbright picture, with very little effect from the brightness control. Retrace lines were visible. With the cabinet back removed, it was found that there was no control whatsoever with the Screen pot on the tube base PCB.

CURE: This kind of fault is usually caused by the failure of a 10uF 250V electro on the video out B+ rail. However, in this case it was R369, an 820k ohm 1W resistor on the tube base PCB. This resistor is part of the 400V screen supply network and when it went open it took the screen up to 700-odd volts.

This information is supplied by courtesy of the Tasmanian Branch of the Electronics Technicians' Institute of Australia (TETIA). Contributions should b sent to J.Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.

ALTRONICS 24 HOUR EXPRESS DELIVERY

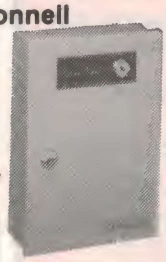
'Our customers are often amazed at the speed and efficiency of our Jetservice Courier delivery. Phone your order Toll Free 008 999 007 and presto we can deliver your order next working day (country areas 24-48 hours later). Our famous ***14 day satisfaction money back guarantee*** protects your hard earned $$$'s should ever a purchase be unsuitable for your needs. I invite you to try Australia's best electronics phone order service soon.'

Regards, Jack O'Donnell

Economy Alarm Panel

For Homes and Small Commercial Premises

This is a 3 zone alarm control panel designed for the protection of homes and small commercial premises. It employs the latest advanced electronic circuitry offering the highest degree of quality and reliability. It will accept either active or passive normally open or normally closed sensors making it both a versatile and effective protection system. 12V battery charger inbuilt. See Altronics '91 catalogue for full details.



S 5480 **$129.00**

Keyless 4 Sector Alarm Control Panel

This 4 zone panel has been suitably designed for the protection of both commercial and residential properties. It employs the latest electronic circuitry and the most up-to-date security technology. It has 4 independent individually isolatable protection circuits accepting both normally open or normally closed sensors. The panel is easily armed and disarmed via the integral inbuilt keypad. 12V battery charger inbuilt. See Altronics '91 catalogue for full details.

S 5485 **$249.00**

Economical Alarm System Kit

The kit comes complete with the following components: • One Alarm Panel • One Passive Infrared Detector (P.I.R.) • One AC Power Pack • One 8 Ohm Horn Speaker • Three pairs of Magnetic Reed Switches • One 12V/1.2AH Rechargeable Back Up Battery.

Features: • 5 Protection Circuit Loops • Independent Connections for N.C. and N.O. Sensor Switches • Arm - Disarm by Digital Access Key-pad • Multi-Station Remote Control • Warble Tone — Steady Tone Siren Driver • Adjustable Timers for Entry Delay and Siren Duration • "Latch" and "Timing" Output Relays • Remote and Local Alarm Status Indication • See Altronics '91 catalogue for full details.

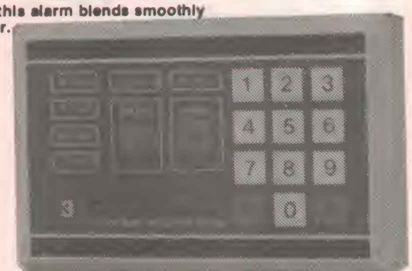
SUPPLIED WITH ALL MAJOR COMPONENTS, DETECTORS, 12V BATTERY BACKUP AND EVEN CABLE

S 5470 **$349.00**

Flush/Surface Mount Alarm Control Panel

With stylish compact good looks this alarm blends smoothly into any residential or office decor.

This compact 3 sector alarm panel has been designed to either surface mount or flush mount into a standard 3 gang electrical wall box. In order to provide the maximum amount of security and operation convenience the panel is operated via a 4 digit access code rather than a key. For ease of installation and service, the panel is provided with a plug in wiring harness. See Altronics '91 catalogue for full details.



S 5490 **$119.00**

Optional Accessories: • M 8020 Charger **$12.50** • S 5065 Battery Backup **$29.95** (see Below)

FREE THIS MONTH ONLY- 100m ROLL CABLE and 4 LARGE WARNING STICKERS WITH ANY PURCHASE OF THE ABOVE SYSTEMS THATS A SAVING OF OVER $40!

Strobe Signal Lamps

Uses Xenon Strobe tube for high energy flash output at a rate approx. 1 per seconds. Fantastic light energy output for the DC power used. DC input 12V 320mA.

Ideally Suited To Our Control Panels Above!

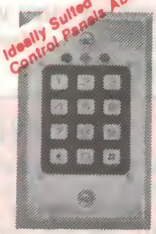
S 5455 Blue **$34.95**

S 5450 Red **$34.95**

Digital Access Keypad

This digital access keypad is a 12-button electronic coded combination lock. It provides two sets of secret codes for the owner. There are 11880 different combinations possible for secuirty key and 132 different combinations possible for panic. The secret codes may be instantly changed by the owner by just simply rearranging the code jumper pins on the PCB. See Altronics '91 catalogue for full details.

Ideally Suited To Our Control Panels Above!



S 4200 **$69.95**

Super Small PIR Detector

VERY UNOBTRUSIVE

Incorporating the latest technology this compact Passive Infra Red Detector (P.I.R.) features Pulse Count Triggering which virtually eliminates false alarms. See Altronics '91 catalogue for full details.

Incredibly Small Only 55 x 31 x 73mm

S 5302 **$79.00**

Alarm Stickers

Extra large for home. 200x75mm.

S 5400 **$1.95ea**

For your car (fixes to inside of window). 70x25mm.

S 5410 **$3.95 set of 4**

12V Battery Charger

Charges any 12V Gell Cell at 300mA.

M 8020 **$12.50**

Backup Battery

1.2AH, 12V gell cell. A quality GS product made in Japan. To suit above alarm panels.

S 5065 **$29.95**

Battery Operated Portable Passive Infra-Red Intrusion Alarm

• A ready to use system, no installation • Fully automatic operation, very user friendly • Large coverage, over 100 square metres • Portable or wall mounted • Long life 9V battery operation • Battery low warning • Lightweight, compact and attractive • Recommended for home, shop, caravan or when travelling.

Be quick. Next shipment! will be priced at ~~$69.00~~

S 5305 **$49.00**

High Power Car Alarm

With Wireless Remote Control

Amazing price for an Alarm System offering these facilities

Audible warning with a 125 decibel loud siren and visible warning of flashing headlights when the alarm system is triggered. Keyring remote control allows arming with 'beep' sound and disarming with a headlights flashing signal. The alarm system will be triggered by unauthorised entrance through the car doors, boot, bonnet or removal of the car sound unit. The siren will sound and the headlights flash for 60 seconds. **Easy to Install.**

S 5220 **$99.00**

Free Bonus of 4 car Alarm Stickers This Month Only!

Pin Point Ultrasonic Cleaner

Awarded the Good Product Design Award for CETDC in 1987. This fantastic Ultrasonic Cleaner can earn its cost a hundred times over in cleaning Computer Connectors, PCB's, Switches, Relays, Jewellery, Glasses Watches etc.

Power Supply: 240V
Capacity: 570ml
With 3 Minute Auto Timer

NOW BACK IN STOCK

A 0100 ~~$199.00~~

This Month **$175.00**

Squeeky Clean Mains Filters

SINGLE FILTERED DOUBLE OUTLET MODEL

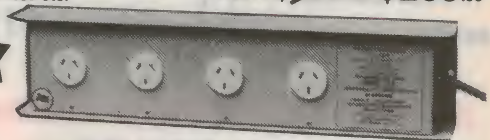
Just the shot for home computer or for individually located peripherals. Eg remote printer, computer terminal etc.

P 8150 ~~$119.00~~ **$99.00**

4 OUTLETS WITH 4 WAY FILTER MODEL

Each individually filtered. A must for "serious" computer installations eg for Schools, business etc.

P 8160 ~~$289.00~~ **$269.00**



17 Range Digital Multimeter

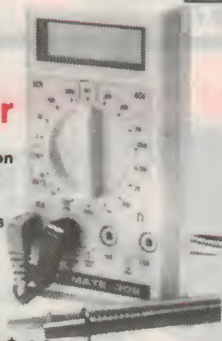
With overload protection
DC Voltage to 2000V 4 ranges AC Voltage to 500V 2 ranges DC current to 10A 4 ranges Resistance to 2 meg other 5 ranges Plus diode and battery tester. Includes 9V battery and probe set.

Q 1056

Normally great value at ~~$49.95~~

This month for the very quick only **$39.95**

Q 1057 Carry Case to Suit **$12.50**



Our Top Selling Autoranging LCD Multimeter

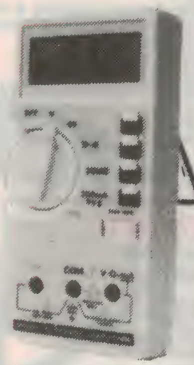
With Memory Function and Bar Graph Display

This popular 3.5 digit Multimeter is simplicity itself. Full auto ranging on voltage and resistance measurements. The large LCD digits allow quick and efficient reading of measurements.

• 42 Segment Bar Graph Display • Auto-ranging on Voltage and Resistance • Memory Mode • Low OHM Range • Hold Facility • Autmatically indicates negative inputs • Low Battery Indicator • Continuity check with Buzzer.

Q 1075 Normally ~~$119.00~~

Now only **$99.00**



Tuck this fantastic sine/square wave oscillator away in your tool box

Pocket Sized, Personal Audio Signal Generator

This pocket sized oscillator has all the features of a large bench oscillator. 46 preset switched frequencies ranged from 20Hz to 150kHz, eg: 1kHz, 1.2kHz, 1.5kHz, 1.8kHz, 2kHz etc. Smaller than most multimeters, this is ideal for technicians, servicemen, students and hobbyists who require an accurate and reliable oscillator ready to use anywhere.

Q 1542 ~~$95.00~~

This Month Only **$80.00**

Cut and Clinch Tool

• Cuts, clinches and burnishes component leads in one stroke • Burnish improves solder wetting • Lightweight and comfortable • Rugged aluminium body • Durable steel mechanism • For production or prototypes.

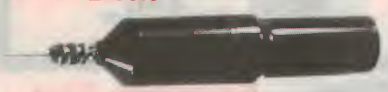
T 2800
Normally ~~$35.00~~ This Month Only **$25.00**

Economy Rack Cabinet

• Solid steel construction • Black anodised front panel • 3 unit (132mm) • Conforms to International Standards • Ventilated top and side panels

H 0400 Only **$69.95**

Powerful 6000 RPM Mini Drill



For PCB Work
Tons of torque. Just the shot for PCB work. 12V DC operation from optional power pack. Comes with 0.8mm and 1.0mm chucks. Plus one 1.00mm drill bit.

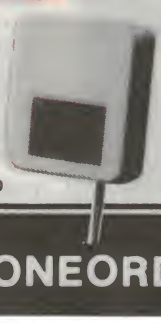
T 2302 ~~$21.50~~ This Month Only **$15.00**

Replacement Drill Bits for PCB Work
T 2320 0.8mm **$3.50**
T 2325 1.0mm **$3.50**

12V 1 Amp Plug Pack

To suit above drill

M 9022 ~~$22.50~~ **$18.00**



Sensational Value On UHF Alarm Systems

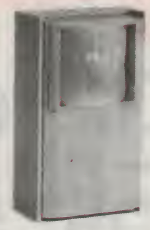
Main Control Receiver

The main control receiver runs on 240V AC with a 12V 1.2Ah battery for emergency backup. The range between the transmitters and the receiver is normally 80 metres in open space.

Features: • Wireless reception of external and internal sensors & detectors • Selectable home or away modes for selecting internal or external arming or just external to allow movement inside the building • Built in piezo electric siren gives different signals to indicate different functions • Sends signal down power line to activate remote siren • Programmable arm/disarm switch buttons

Passive Infra Red Movement Detector

Ideal for the loungeroom, family room or hallways. Mounts up on the wall or bookshelf. Detects movement within an area of 9 x 9m.



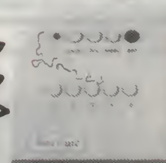
Remote Reed Switch

This consists of an enclosed reed switch and transmitter with a magnet.

Remote Piezo Alarm

This unit is a line carrier receiver, ie. plugs into 240V AC and receives signal through AC line.

Requires no wiring which makes it a cinch to install. Do it yourself and save on installation and over 50% off regular prices.



Front Door Remote Keypad

This handy unit virtually duplicates the function of the main control unit but at a more convenient location, ie. just inside the front or rear door etc. System can be armed or disarmed without the need to go to the main control unit.

SYSTEM 1
Includes:
1 x Main Controller
3 x Remote Reed Switches
1 x Remote PIR Movement Detector
1 x Remote Keypad
1 x Remote Siren
Plus 4 Bonus Large Alarm Warning Stickers
This Month Only **$399**
NORMALLY ~~$865~~

SYSTEM 2
Includes:
1 x Main Controller
3 x Remote Reed Switches
Plus 4 Bonus Large Alarm Warning Stickers
This Month Only **$249**
NORMALLY ~~$515~~

SYSTEM 3
Includes:
1 x Main Controller
1 x Remote Reed Switch
1 x Remote PIR Movement Detector
1 x Remote Keypad
Plus 4 Bonus Large Alarm Warning Stickers
This Month Only **$299**
NORMALLY ~~$630~~

PHONEORDER TOLL FREE ALTRONICS 008 999 007

Nicad Battery Super Sale!

Definitely Australia's lowest prices on quality Nicads!

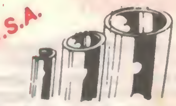
		Normally	1-9	10+
S 5020	AA 500 mAH	~~$3.9[illegible]~~	$2.50	$2.20
S 5021	AAA 180 mAH	~~$4.[illegible]0~~	$3.50	$3.20
S 5022	'C' 1-8 AH	~~$1[illegible].00~~	$7.50	$6.00
S 5023	'D' 4 AH *Super Heavy Duty*	~~$1[illegible].50~~	$12.00	$11.00
S 5024	9V	~~$16.[illegible]5~~	$12.50	$11.50

Rubberised Commercial Grade Heatshrink Tubing

(Shrinks approx 50%) The heat from your soldering iron barrel is all that is required with this tubing. Sold by the metre.

		Per m	10m up
W 0550	1.6mm (1/16")	$2.95	$2.70
W 0552	3.2mm (1/8")	$3.45	$3.15
W 0554	6.35mm (1/4")	$5.10	$4.55
W 0556	9.5mm (3/8")	$5.75	$5.15
W 0558	12.7mm (1/2")	$6.45	$5.80
W 0560	19mm (3/4")	$8.85	$7.95

Made in the U.S.A.



Bargain Hobby Packs

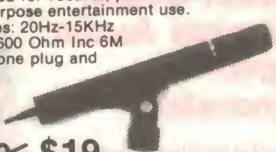
Mixed selection of above normally ~~$4.95~~

W 0567 A Bargain $4.00

Microphone's Prices Slashed in Half

Uni-Directional Cardioid

Recommended for vocalist, public address & general purpose entertainment use. Frequency res: 20Hz-15KHz Impedance: 600 Ohm Inc 6M lead with phone plug and wind screen. Uses 1.5V AA battery.



C 0360 ~~$39.50~~ $19.75

Omni Directional

Recommended for recording & eminently suited for wide angle sound pickup ie: choirs, orchestras, etc. Frequency res: 50Hz-18KHz Impedance: 1K Ohm Inc 6M lead with 6.5mm phone plug and wind screen. Uses 1.5V AA battery.

C 0365 ~~$39.50~~ $19.75

Economy Parts Cases

Just the shot for all those 'bits and pieces' laying around! Available in three nifty sizes. Complete with partitions to custom make your own compartments.

H 0246 15 Way (260x175x43mm) $10.50

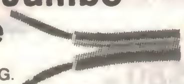
H 0247 6 Way (210x110x44mm) $5.25

H 0248 5 Way (175x95x38mm) $3.50

Attention Audiophiles!

Optimise Your Sound System With This Oxygen-Free Cable

Twin Jumbo Cable

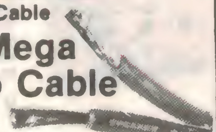


204 x 16 AWG.

W 0136 Normally ~~$29.95~~

This Month $20 PER 16m ROLL

Twin Mega Jumbo Cable



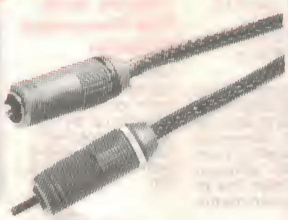
504 x 12 AWG.

W 0138 Normally ~~$55.00~~

This Month $45 PER 16m ROLL

High Quality Oxygen Free Copper Audio Leads

All Plugs and Connectors Gold Plated



P 0438 1 RCA/1RCA 1.8m $9.50

P 0440 2 RCA/2 RCA 450mm $11.00

P 0442 2 RCA/2 RCA 900mm $12.00

P 0444 2 RCA/2 RCA 1.8m $13.50

P 0446 2 RCA & Earth Lug each end 900mm $16.00

P 0448 2 RCA & Earth Lug each end 1.8m $19.50

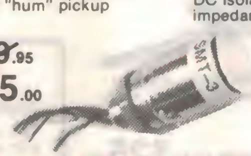
MU Metal Shielded Audio Transformers

Microphone Type: Primary: 200 Ohm Secondary: 50K Ohm. A high quality item eminently suited to mixers, PA amplifiers and where an ultra low "hum" pickup level is desired.

M 0701 Normally ~~$39.95~~

This Month Only $25.00

10 Up $23.00



Bridging/Isolating Type: Use for coupling audio modules. Prevents earth loops, hum etc. Essential coupling device where DC isolating is required. Nominal impedance ratio 10K: 10K (1:1).

M 0702 Normally ~~$34.95~~

This Month Only $25.00

10 Up $23.00

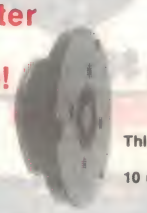
160 Watt 6" x 9" Triaxials

Includes mounting hardware and cable • High performance 6" x 9" 3-way speaker • Power handling 160 watts max • 4 Ohms impedance • Dome tweeter • Hi-grade barium ferrite magnet • Frequency response 50 to 22,000Hz

C 9334 ~~$139.95~~ $99.00

Superb Dome Tweeter Bargain of 1991 Less Than ½ Price!

Dome Tweeter With Ferro Fluid 60 Watt Max. Power. Silky smooth frequency response 1.5Hz to 20kHz. Wide angle dispersion. Massive power handling capacity. Diam. 94mm. High spectrum. Purity. Incredible low price!



C 3012 ~~$29.50~~

This Month $12.00

10 up $10.00

High Performance 2 Way Flush Mounting Full Range 60W Speaker System

"Highly recommended. I found it difficult to pick the difference between the Altronics C 0880, the American Sonance and Boston Acoustic Systems, both costing around $600 a pair"
— John Negus leading WA Audiophile

Building that extension? What great speakers to install. Designed to install into ceilings or walls this slim profile attractive speaker system/grille assembly will compliment any sound system. Once installed the finished unit blends beautifully into any decor. (The grille assembly can be painted over in the same finish as walls or ceilings if required).
Installation is simplified by the use of a mounting frame (which could be installed during construction) which the speaker assembly attaches to. Full mounting kit (even screws) supplied.

C0880 ~~$125.00~~ ea

This Month's Special $99.00 ea

Front Grille Not Illustated.

Plasma Lamp Display

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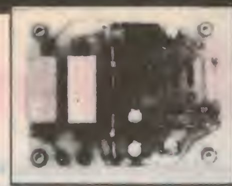

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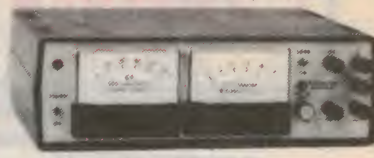

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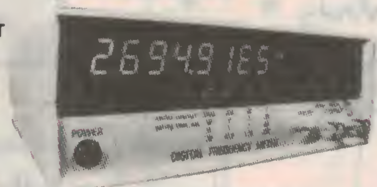

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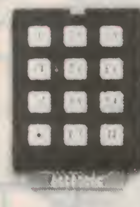
Four Digit Combination Lock

Operates from 10-30VDC (or 8xAA cells)



Fits easily to std. electrical swithplate cat. P 8040. Use with electric door strike/release cat. S 4930.

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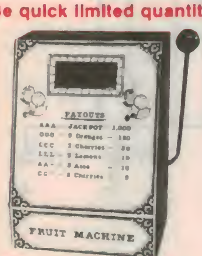

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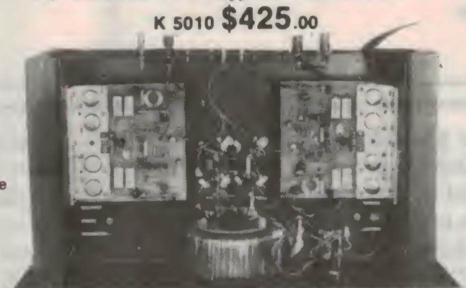

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Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Sweep oscillator

Wanting to check the frequency response of some audio amp filters I had built, I came up with this low cost sweep oscillator to use with my CRO.

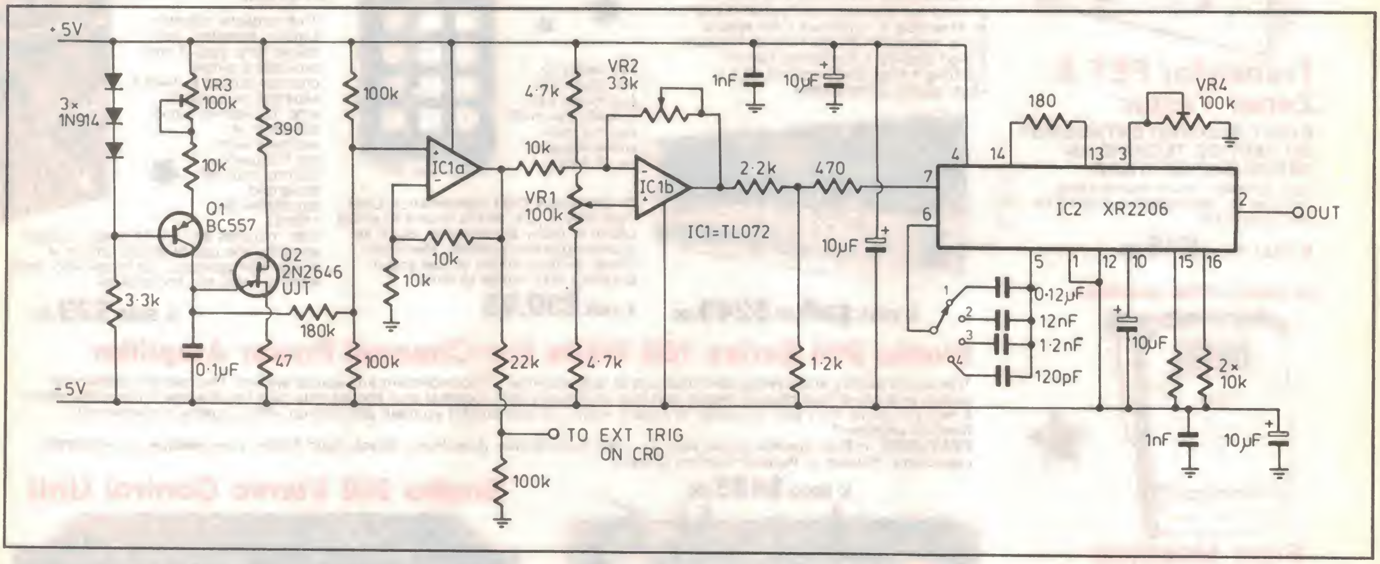
Transistors Q1 and Q2 form a linear ramp wave oscillator which is buffered by IC1a to prevent the loading affecting it. IC1b is the control amp whose output voltage is converted into frequency by IC2, which is wired up to produce a sine wave (pins 13-14). VR1 varies the DC level on IC1b's positive input, to set the centre frequency, while VR2 adjusts the gain to set the sweep width. Trimpot VR4 controls the final output level.

I found it best to keep this output low, as the output drops off with the higher frequencies.

Setting up is best done on the highest frequency range, with VR1 set to mid-way and VR2 to half way or more. Set the CRO timebase to 1ms per division, and adjust its trigger level so that the trace starts just on the edge of the screen.

Then adjust trimpot VR3 so that one sweep of frequencies occupies the full width of the screen. My oscillator was built on strip-board and cost about $30. It works well.

Peter Buckman,
Boggabri, NSW. **$40**



Turbo timer

Turbo timers allow the engine to continue running for a short time to cool down, even after turning off the engine and withdrawing the ignition key. I use a 555 IC circuit as a turbo timer on my four wheel drive diesel Jackaroo.

The homemade version cost me roughly one tenth the price of a commercial unit. When the ignition is first turned on, diode D2 allows current to flow to the relay.

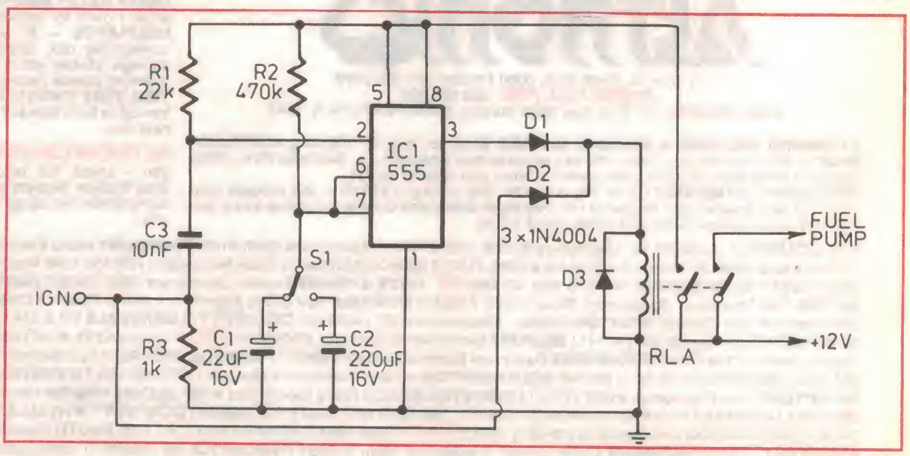
The relay activates the fuel pump, opening the fuel solenoid valve so that the vehicle can be started. The 'IGN' voltage continues to hold the relay on until the ignition is switched off.

Turning the switch off makes C3 deliver a negative pulse to the trigger (pin 2) of the 555, which makes its output (pin 3) go high.

This provides the power which continues to hold on the relay. Pin 7 now no longer provides a discharge path for capacitor C1 or C2 (whichever has been selected by switch S1), so the capacitor begins to charge via resistor R2. When the voltage at pin 6 is high enough, it resets IC1.

With the timing period now complete the relay is released, and so the solenoid valve closes and stops the engine. The length of time the engine continues to run can easily be adjusted by varying R2 as well as C1 and C2.

N.C. Albrechtesen,
Miriam Vale, Qld. **$35**



Temperature controller

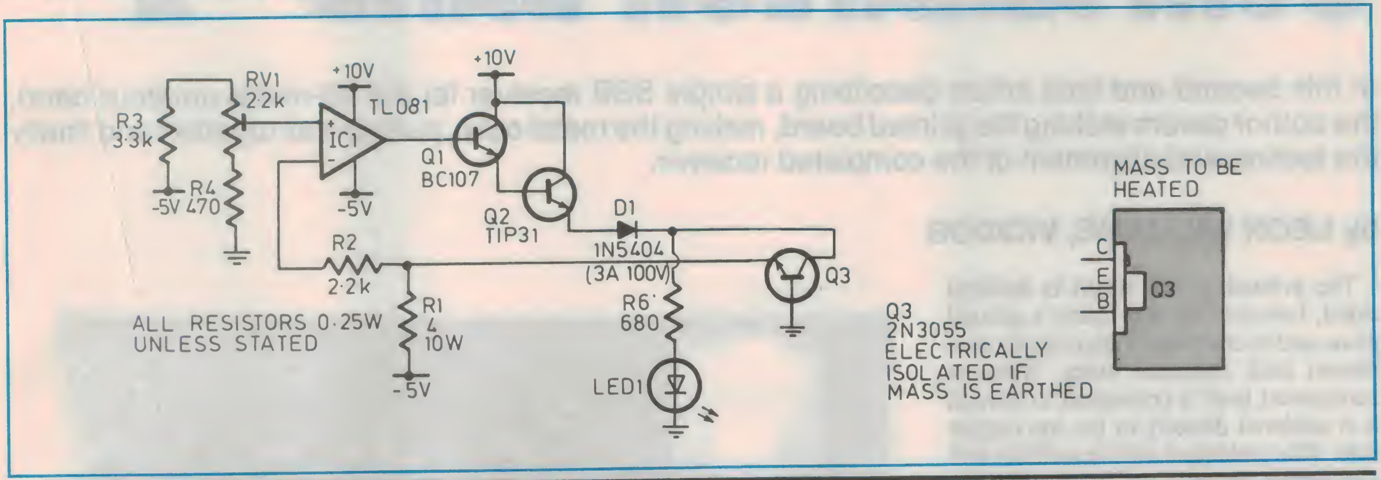
This circuit uses transistor Q3 to both heat and sense the temperature at the same time. IC1 (TL081) compares the base emitter voltage of Q3 with the set-point determined by RV1, and turns the current on or off as appropriate via Q1 and Q2. Resistor R1 causes an Ie of about 1A — other values could be used for different currents, e.g., 18 ohms would give about 250mA. LED1 switches on when the circuit is heating.

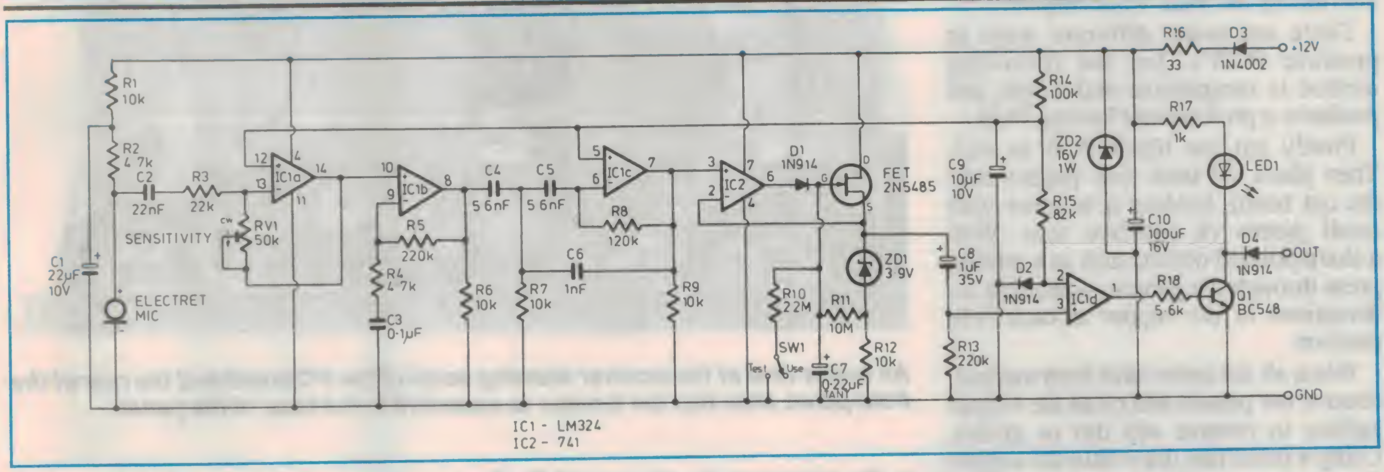
The only disadvantage with the circuit is the need for a second (negative) stable supply, but this is not too onerous these days. The circuit has performed satisfactorily for over five years without any problems, maintaining (50 +/-0.2)° over many measurements in that period.

Possible modifications to the circuit could include mounting the TIP31 on the thermal mass being controlled, as it dissipated heat at the same time as the 2N3055. Alternatively, you could replace the TIP31 with a second 2N3055 and mount one transistor on each side of the mass.

The circuit was adapted from a design by Neil Dvorak, published in *Electronics Australia* for March 1976.

R.W. Phelps,
Ferntree Gully, Vic. **$35**





Car vandalism detector

This circuit is the product of considerable research into the problem of detecting vandalism around the boot area of a car, while providing reasonable immunity from the false alarms from jet aircraft, noisy cars and heavy rain, etc, which seem to plague commercial vibration detectors. The unit is mounted beneath the rear parcel shelf, and uses an electret capacitor microphone to listen for the characteristic fast rise-time, high-frequency sounds of coins on paintwork, badges being prised off and the like — as well as operation of the boot and rear door looks. However, it ignores low frequency sounds and those which increase in loudness relatively slowly, which are the source of most false alarms.

IC1a and IC1b form a low output impedance preamplifier feeding IC1c, configured as a high-pass filter to sharply attenuate frequencies below 1800Hz. IC2 and its associated components form an active rectified circuit which places a bias voltage on the 0.22uF capacitor C7, and adds the position peak output voltage from IC1c to this voltage. The 3.9V zener diode ZD1 and 10M resistor R11 provide a constant discharge current for this 0.22uF capacitor under normal conditions; however, the discharge time can be reduced from several seconds to a fraction of a second for setting up purposes by connecting the 2.2M resistor R10 into circuit. This prevents the circuit temporarily 'going deaf' as you check for its ability to detect high level sounds. The 2N5485 FET is set up as a source follower to allow the use of this small 0.22uF peak-holding capacitor and 10M discharge resistor. Fast positive-going variations are coupled by the 1uf capacitor C8 to IC1d, which switches on transistor Q1 (BC548) for a few hundred milliseconds when signals exceed the approx 0.6V reference voltage on pin 2 of the IC. The circuit is protected from reverse supply polarity by diode D3 (1N4002), and potentially-destructive supply transient voltages are caught by the 16V zener diode, ZD2.

My original unit is connected to the instant ground triggered input of a commercial silent 'paging' car alarm, and draws about 4mA under non-triggered conditions.

Bob Parker,
Carlton, NSW **$45**

Construction Project:

SSB RECEIVER FOR THE 80M AMATEUR BAND - 2

In this second and final article describing a simple SSB receiver for the 80-metre amateur band, the author covers etching the printed board, making the metal case, putting it all together and finally the testing and alignment of the completed receiver.

by LEON WILLIAMS, VK2DOB

The printed circuit board is doubled sided, however the top forms a ground plane and is continuous apart from component lead clearance holes. Where a component lead is connected to ground it is soldered directly to the top copper side. This technique aids in stability and also makes the track work simpler.

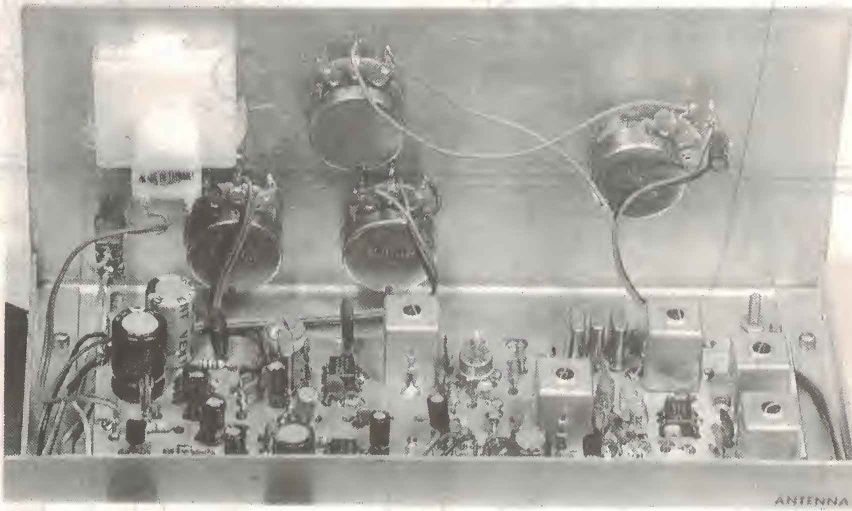
There are many different ways to produce PCB's, but the following method is inexpensive and simple and produces a professional looking PCB.

Firstly cut the blank PCB to size. Then place the track side pattern onto the cut board, holding it in place with small pieces of adhesive tape. With a sharp pointed object, such as a scriber, press through the pattern — making indentations in the copper at each hole position.

When all the holes have been marked, remove the pattern and clean the copper surface to remove any dirt or grease. Using a resist pen draw onto the copper the tracks according to the pattern. When the resist is dry cover the other side (groundplane) with something to stop the etchant from etching this side. I have used plastic packing tape with good results. You could use resist, but this would be wasteful.

Once this is done, etch the board in the usual way. After etching, clean off the resist and remove the tape. Drill the board using the marks made before as centres. Some of the holes will need to be larger than normal to mount the coils. While at this stage drill 4 holes in the corners for the mounting screws.

Now, using a large drill, enlarge the area around the holes on the groundplane side where component leads are not soldered to the top. This requires a little patience and reference to the wiring/overlay diagram of Fig.3, where the only holes that don't need enlarging are those marked with a dot.



An inside view of the receiver showing some of the PC board and the rear of the front panel. Note that the S-meter is cemented to the back of the panel.

A spray of clear PCB lacquer will enhance the appearance of the completed board, but is not compulsory.

Winding the coils

There are five coil assemblies in this receiver, with a total of nine windings. They are all wound on 5mm coil assemblies, each comprising a former, a 6-pin base, a can and a slug.

The first step is to glue the former into the base. Then using 0.2mm diameter enamelled copper wire, wind the number of turns between the pins as shown in Table 1, for the respective coil winding.

I have found that the easiest and quickest method is to solder the end of the wire into the start pin, wind on the required turns and while holding the turns tight, cut off the excess wire and solder the end to the end pin. This can be made easier if you melt some solder on the pins beforehand. The enamel can be removed by heating the end of the wire with the soldering iron.

Remember to glue the windings so that they cannot move. This is especially true of the VFO coil L5. I used 'Tarzans Grip' to both mount the former to the base and also to secure the windings.

Assembling the PCB

Place the components on the PCB following the layout of Fig.3. As mentioned before the PCB is doubled sided,

TABLE 1

COIL WINDING DATA

Winding	Start Pin	Stop Pin	Turns
L1	1	5	3
L2	2	6	26
L3	5	6	26
L4	2	1	20
L5	1	5	30
L6	1	5	26
L7	2	6	8
L8	1	5	26
L9	2	6	10

(Former and pins viewed from above)

with the top side being a groundplane. Component leads soldered to the top side are marked with a dot.

Some leads are soldered to the bottom tracks as well as the groundplane. This provides a ground connection for components with leads that cannot be soldered to the top, such as the electrolytics. The coil cans are soldered to the top only, to allow them to be removed easily if required later.

The mounting procedure should be in this sequence: resistors, PCB pins, diodes, non-polarised capacitors, polarised capacitors, coil formers, crystals, and finally the transistor and integrated circuits.

As you mount the polarised components, double check that you have them in the right way. The CA3028 is a 8-pin round package and pin 8 is directly under the tab. Mount the crystals close to the board, and make the leads of the capacitors in the RF section as short as possible.

Note that it is important that all components be mounted and soldered before power is applied, because some components get their earth connection from other adjacent components.

Making the case

While it is possible to purchase a ready made case suitable for the receiver, they have become rather expensive. To continue the 'homebrew' theme, I am going to describe an easy method to produce a cheap, easy to make and good looking case.

You will need to obtain a 400 x 400mm sheet of 1mm thick aluminium, and a 320mm length of 10mm X 10mm aluminium angle. As well you will need some basic tools, which should be found in any workshop.

Mark out the sheet as shown in Fig.4 and cut out the two pieces. Note that there are only two bends in the base and two in the lid, forming two 'U' shapes. The bends are made by placing two pieces of angle iron in a vice, forming extended jaws.

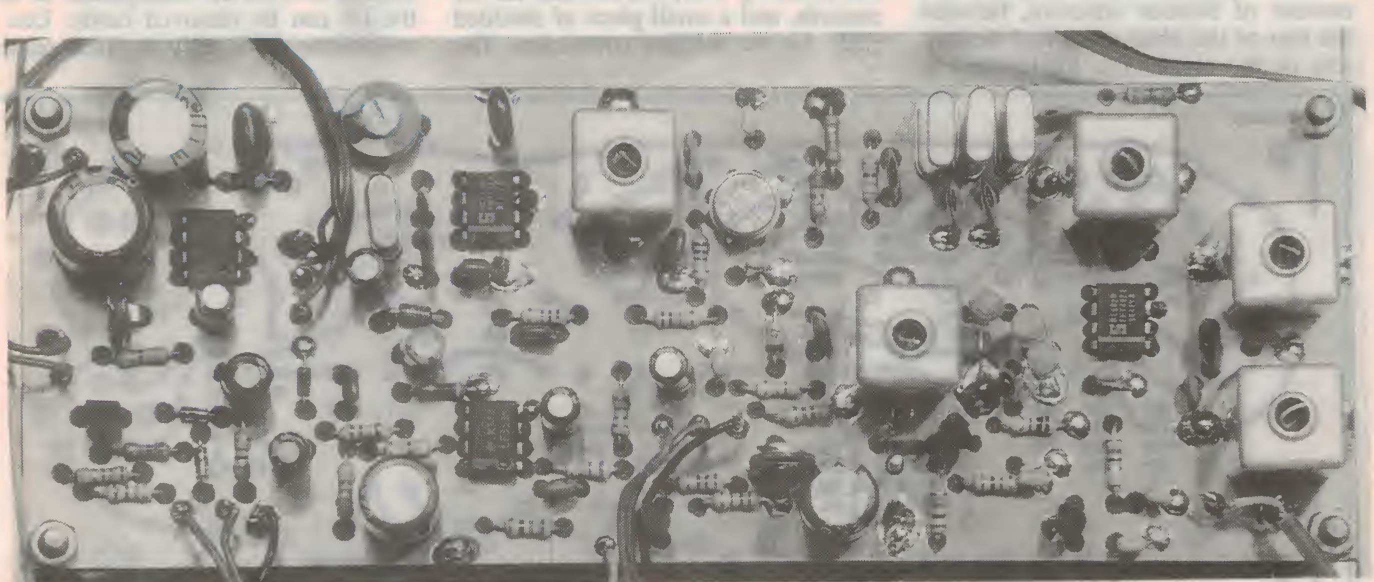
The cut out pieces of aluminium are placed between the pieces of angle iron and carefully aligned so that the bend marks meet with the top of the angle iron. The vice is then tightened and the aluminium is bent over by hand and then formed to a right angle by gently hammering it while using a piece of soft wood between the hammer face and the aluminium.

When the metal is bent, cut the aluminium angle in half and place it along each edge on the inside of the base. With the upright side of the angle flush with the edge of the base, drill two holes through both pieces. Then using either self-tapping screws or pop rivets, mount the angle to the base. This angle strengthens the base and provides a point for the lid to be attached.

Now that you have got your case you will need to drill the holes. Fig.5 shows the layout for the front and rear panels.

As well, four holes are required to mount the PCB, four holes to secure the lid, four holes for the rubber feet, and a pattern of holes in the right side of the lid towards the rear to suit the loudspeaker.

With all the drilling done, check that



A close up view of the top of the PC board, to guide you in its assembly. Use it in conjunction with the wiring/overlay diagram shown overleaf. Note that the leads of some components are soldered to the ground plane copper on the top of the board.

all the edges and holes are clean and free of burrs.

To give the case a good appearance, the lid should be spray painted. I chose matt black for the colour, but this is a matter of personal preference.

Before spraying, prepare the surface by using a wire brush or fine sandpaper in long even strokes over the surface, starting and finishing off the edges.

This rids the surface of scratches which may have been caused during construction. Finish off by scrubbing the surface with a plastic scouring pad as found in the kitchen, and wiping over with a clean rag. Once this is done spray paint the lid, and when dry apply a thin coat of clear lacquer.

The front and rear panels are prepared in the same way. This time however spray the panels with a light coating of clear lacquer.

Using rub-on lettering place the labels for the controls on the front panel. Then give both the front and rear panels a final coat of clear spray and let to dry.

Wiring up

Wiring the receiver is straightforward and should not provide any difficulties. Start by mounting the pots, meter and switch onto the front panel, and the banana sockets, headphone socket and antenna socket on the rear panel. Place an earth lug under the nut of one of the mounting screws of the antenna connector.

The S meter is placed through the cutout and held in place by a small amount of silicone adhesive, between the rear of the front panel and the bottom of the meter. The loudspeaker is mounted by placing a ring of silicon adhesive around the outside of the loudspeaker and placing it on the inside of the lid until the adhesive cures.

The PCB is mounted using four 12mm brass standoffs and 3mm screws and nuts. The wiring is then done using small hookup wire, ribbon cable for the controls, and a small piece of shielded cable for the antenna connection. The PCB pins allow easy connection to the PCB without having to turn it once mounted. The ground connection for the power supply is made by soldering directly to the groundplane.

Remember to keep wiring neat and away from the VFO components. Allow enough wire for the loudspeaker so that the lid can be removed easily. Use a multimeter to identify the pins on the

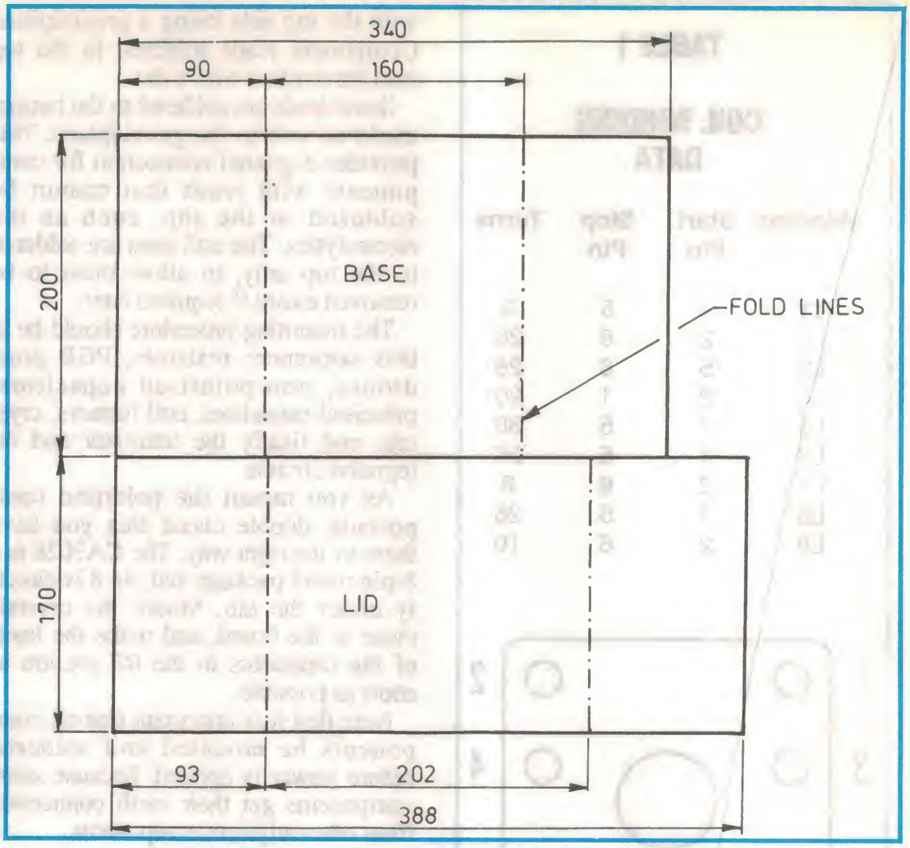
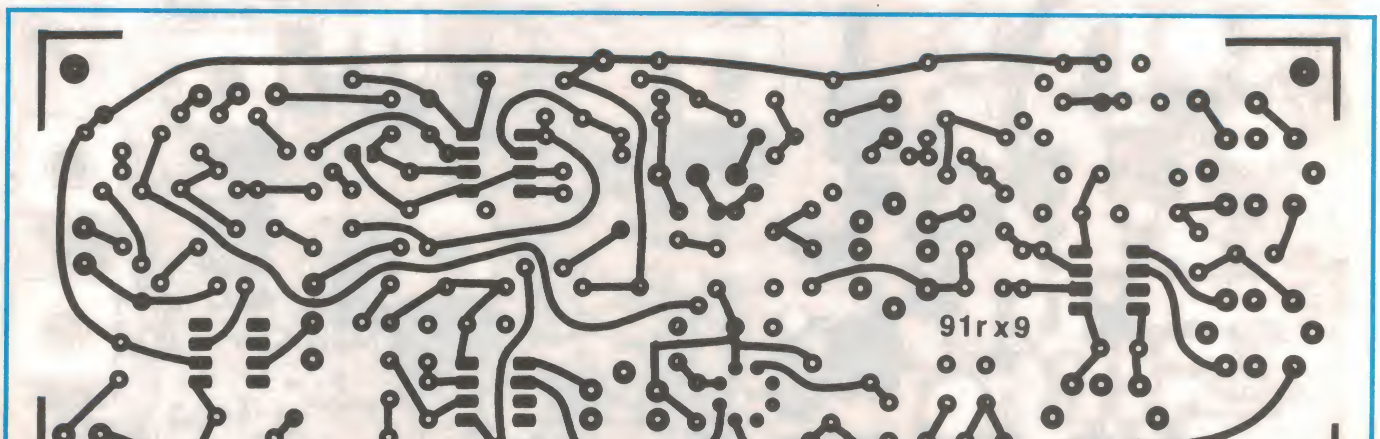


Fig.4: For those who wish to make their own metal case, here are the dimensions for the base and lid sections. Both pieces are cut from 1mm aluminium sheet.



And here is the actual size PC board pattern, for those who wish to make their own.

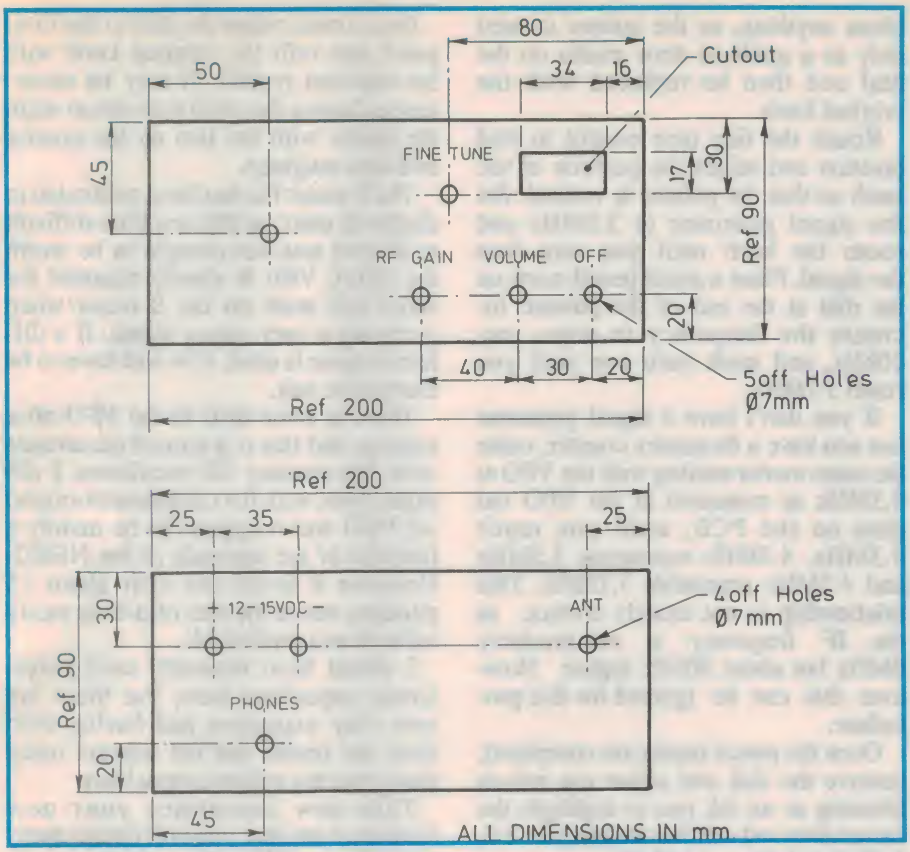


Fig.5: Use this drawing as a a guide to drilling the holes in the front and rear panels and also when you're adding the rub-on lettering.

headphone socket. The idea is to be able to plug in stereo headphones, cut off the speaker and drive the headphones in parallel and revert back to the speaker when the headphones are unplugged.

The RF gain control is wired so that maximum gain is obtained with the control in the fully clockwise position. C8 is soldered directly to the lugs of VR2.

The tuning scale is a piece of 80mm diameter white card, glued to a piece of aluminium sheet of the same dimensions. A hole is drilled in the middle and held in place by the main tuning control nut and washer. A piece of thin clear plastic or perspex is cut to shape to form a pointer, with a line scribed down the middle.

This is drilled to clear the tuning control spindle and glued to the large knob. This scheme allows the tuning scale to be removed easily if it gets damaged or needs recalibrating.

Testing & alignment

With the wiring completed, check your work over one more time. Turn the volume control fully anti-clockwise, the RF gain fully clockwise, the two tune controls half way, VR3 half way, VR6 fully anti-clockwise and VC1 half meshed.

Connect a power supply of between 12 and 15 volts DC to the banana sockets and turn on the power. Measure some voltage points around the circuit to check that they are near to those on the circuit diagram. If not, switch off and check for construction errors such as components in the wrong way or bad soldering joints. If all is OK, turn the volume control up and a hiss should come from the speaker.

So far so good; now we will do the initial adjustment of the VFO. Make sure that the receiver has been turned on for at least 30 minutes to ensure that the VFO has reached stability.

I will assume that you have a frequency counter for this exercise, but it is possible to do the alignment another way. This will be discussed in more detail when we calibrate the main tuning dial.

Connect the counter to the VFO out terminals and turn the main tune control almost fully anti-clockwise. Adjust the slug in L5 until the counter reads 4.505MHz. Now move the main tune control almost fully clockwise and adjust VR3 for a reading of 4.295MHz. Verify that the fine tune control varies the frequency by about plus and minus 2kHz. Place the counter on pin 7 of IC3 and adjust VC1 for a reading of 8.0008MHz.

Connect a signal generator to the antenna connector with a frequency of 3.6MHz. If you don't have a generator, you could wait until night time and connect up an antenna to receive on-air signals. Another trick I have used during the day is to bring the receiver close to a television set that is turned on. Televisions are notorious for causing interference to 80M receivers, but in this case they can be helpful.

Rotate the main tuning control until you can hear a strong tone from the speaker. This should occur with the tune control at about half way with a 3.6MHz signal. Adjust L2, L4, L6 and L8 for maximum audio output. This should coincide with a maximum reading on the S meter.

If the S meter needle goes off scale, adjust VR6 to bring it back on scale. If the needle goes backwards, reverse the connections on the rear lugs.

Also if the input signal is too large, it will be difficult to see variations in S meter readings as the coils slugs are moved up and down to obtain maximum gain. In this case decrease the coupling between the generator and the receiver.

Now that you are receiving a signal, you can peak L2 at around 3.55MHz and L3 at around 3.65MHz. This should give a fairly flat response across the band.

Ensure that the slugs in the coils are held in place and won't vibrate from their position. This can be done by placing a small length of string elastic (minus the outer cotton coating) into the former before screwing in the slug.

Try out the RF gain control by turning it anti-clockwise. You should see the S meter needle move up the scale and also hear the background noise decrease. Turning it fully anti-clockwise will almost totally cut off the IF amplifier, so that even the strongest signals are only just audible.

We initially adjusted the BFO frequency to 8.0008MHz. This frequency can be varied by adjusting VC1. I recommend that you experiment with this value to obtain the best performance, as different crystals may exhibit slightly different characteristics.

One way to maximise the USB rejection is to tune across a steady CW signal, such as from a signal generator. As you tune across the signal a high frequency tone will be heard, and this will get lower in frequency as you get closer to zero beat.

At zero beat, that is where the signal

in the passband of the crystal filter is the same frequency as the BFO, no audio signal will be heard. Once you tune past zero beat the tone will increase in frequency.

As this is now the upper sideband, the level should be much lower. VC1 is adjusted to obtain minimum USB signal compared to the LSB level while maintaining acceptable audio quality.

This process is much easier to understand when you actually do it than it is to explain here on paper.

There will be some level detected in the USB because this is not an ideal crystal filter — but it is pretty good just the same. If you are really keen, you could experiment with the values of C20 to C23 to see if you can improve the performance of the filter.

We are just about finished the alignment process; the only job left is to calibrate the main tune dial. Remove the main tuning knob and replace it with one of the other knobs.

Before you put it on, you need to affix a temporary pointer to the knob about 30 millimetres long. This can be just about anything, as the pointer is used only as a guide to draw marks on the dial and then be replaced with the original knob.

Rotate the fine tune control to mid position and adjust the position of the knob so that the pointer is vertical. Set the signal generator to 3.5MHz and rotate the knob until you zero beat the signal. Place a small pencil mark on the dial at the end of the pointer. Increase the frequency in steps, say 10kHz, and mark each one until you reach 3.7MHz.

If you don't have a signal generator but you have a frequency counter, make the same marks starting with the VFO at 4.5MHz as measured at the VFO out pins on the PCB, until you reach 4.3MHz. 4.5MHz represents 3.5MHz and 4.3MHz represents 3.7MHz. This relationship is not exactly correct, as the IF frequency is not precisely 8MHz but about 800Hz higher. However this can be ignored for this procedure.

Once the pencil marks are completed, remove the dial and either use rub-on lettering or an ink pen to highlight the increments and add the frequencies 3.5, 3.55, 3.6, 3.65, and 3.7MHz.

Once done, return the dial to the front panel and refit the original knob with the attached pointer. It may be necessary to loosen the main tune nut to align the marks with the line on the pointer and then retighten.

The S meter has not been calibrated to display S units, as this is a little difficult to do and was not thought to be worth the effort. VR6 is simply adjusted for about full scale on the S meter when receiving a very strong signal. If a different meter is used, R24 will have to be changed to suit.

There is some drift in the VFO after turn-on, and this is a normal occurrence with free running RF oscillators. I did experiment with the components around the VFO and it appears to be mainly a function of the internals of the NE602. However it levels out after about 15 minutes, where the rate of drift is vastly reduced and predictable.

I would have normally used polystyrene capacitors here, but these are now very expensive and having tried them the results did not warrant using them over the ceramics specified.

This now completes your new receiver. I am sure you will obtain many happy hours of listening with it. ■

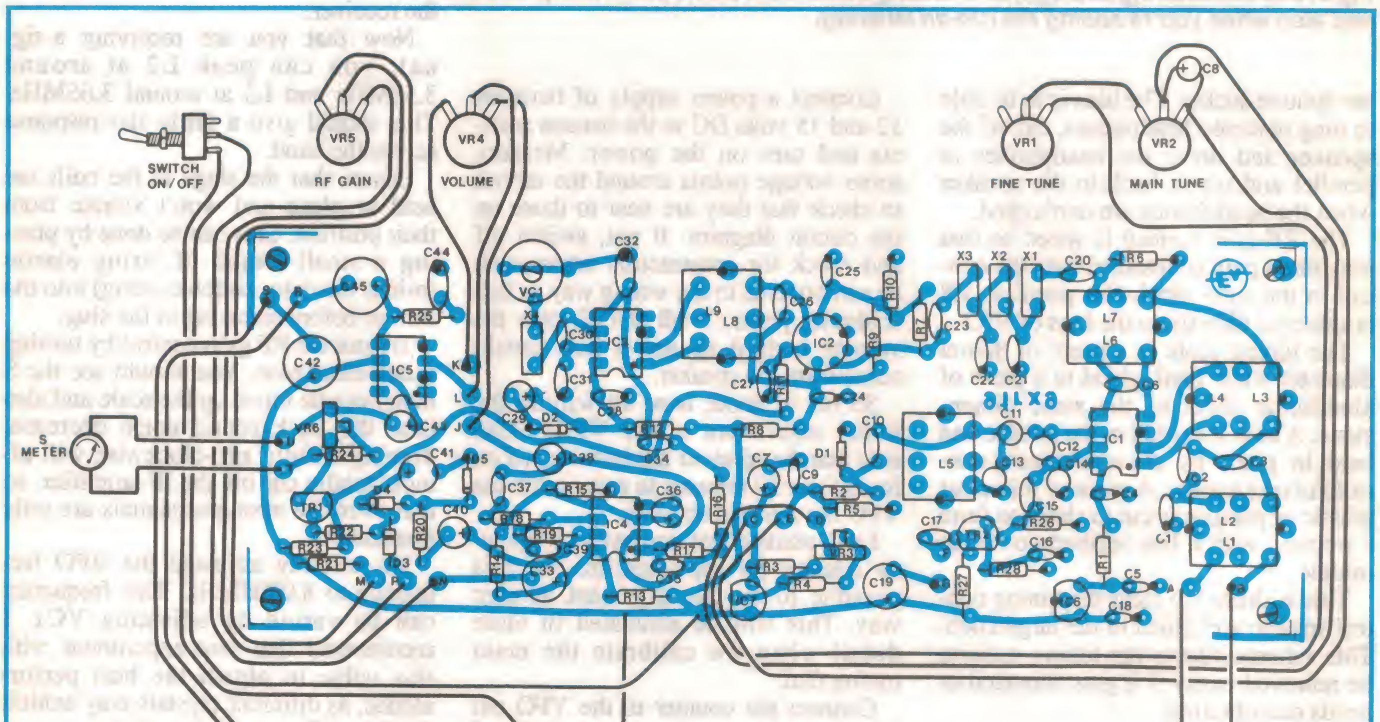


Fig.3: The PC board overlay and wiring diagram for the receiver. The component leads and pins soldered to the ground plane copper are indicated with black dots.

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

December 1941

Gramophone fans: Gramophone fans are probably the most versatile race under the sun as far as radio is concerned. Their likes and dislikes in records alone is as wide and varied as they are themselves. And in the matter of the amplifiers they use, there seems no combination of valves and circuits too unusual for someone to try.

This, of course, is as it should be. It is the privilege of the home-builder to make his own mistakes, experiments, and score his own successes. Few successes are sweeter than those with a really good amplifier system, at least to the man with an ear for sound.

Catalinas from US: Delivery of a number of Consolidated Catalina flying-boats ordered by the Commonwealth Government has been made.

One of the recently delivered Catalinas flew non-stop for 3200 miles between a Pacific island to Australia in 26 hours. This beats the previous Southern Hemisphere non-stop record of 3144 miles, established by Sir Charles Kingsford Smith and Flight-Lieutenant C.T.P. Ulm on their Pacific flight in 1928.

December 1966

High-efficiency LEDs: The efficiency of gallium arsenide light-emitting diodes has been sharply increased by a new fabrication technique developed by scientists at IBM. Diodes made with the new process typically have an external quantum efficiency of 6% as compared with previously reported values of 1% or 2%.

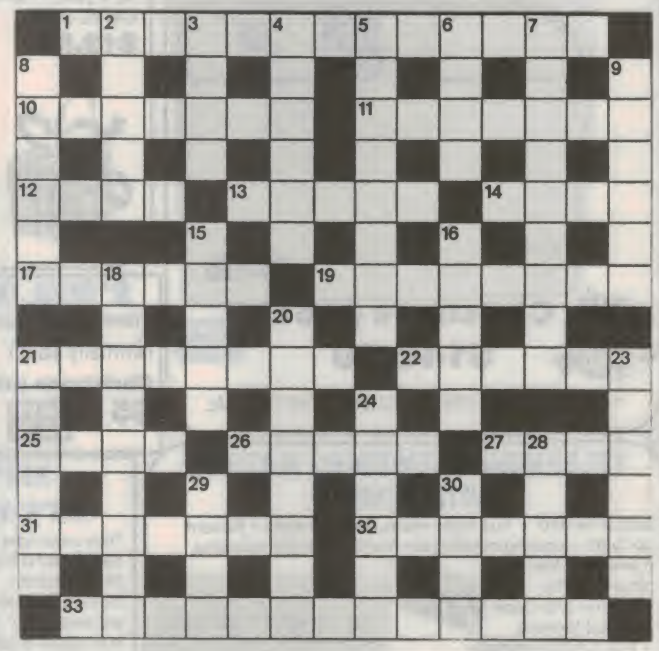
The key to the performance of the diodes is the success of the IBM group in getting silicon to serve as both an N-type and a P-type dopant. Known as amphoteric doping, this effect has only rarely been observed before and has not previously been applied to useful devices.

Silicon is a deeper acceptor than zinc, which is commonly used as the P-type dopant in GaAs, so the light emitted by the new devices is of lower energy than that from Zn-doped diodes. Since the energy of this light is considerably less than the bandgap of GaAs, absorption of light within the diode is sharply reduced. This lowered internal absorption is believed to be the chief reason for the much higher external quantum efficiency of Si-doped diodes.

Electronic simulation: Thousands of square miles of ocean and sky have been 'compressed' electronically into a 40,000-square foot building in California, to train America's hunters of hostile submarines. The new computer-controlled training system simulates 'real-time' actions of an entire anti-submarine warfare task force including ships and aircraft.

On the local scene, the R.A.N. is planning to spend $17 million on training models of equipment to be used at sea. This represents the largest purchase of training equipment in the Navy's history. More than $3 million will be spend on simulators of the Australian-designed Ikara anti-submarine missile system. ■

EA CROSSWORD



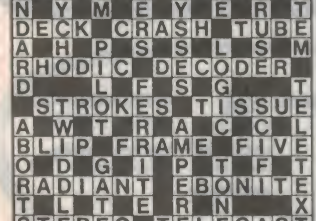
ACROSS

1. Shocking electric device for cardiac emergency (13).
10. Special tape, the head ——. (7)
11. Definition. (7)
12. Output of printer. (4)
13. Said of flying using instruments only. (5)
14. Main station. (4)
17. Physical universe. (6)
19. Frees from contaminates. (8)
21. Bypass a section of a circuit. (5, 3)
22. Parallel components. (6)
25. Said of inoperative computer. (4)
26. Communication cabinet. (5)
27. Radio user's instruction. (4)
31. Measure of the disorder of a system. (7)
32. Initiated a telephone call. (7)
33. Temperature-measuring circuits. (13)

DOWN

2. Remove cassette from VCR. (5)
3. Particles. (4)
4. Is this how often krypton is extracted from air? (6)
5. Producing light. (8)
6. Brand of hi-fi equipment. (4)
7. Distribution of electrons determines the —— number. (9)
8. Said of solution of low pH. (6)
9. Insulated-gate transistors. (6)
15. Security nuts get screwed up over these (5)
16. Its speed is a universal constant. (5).
18. Timer. (9)
20. Aircraft with large rotor. (8)
21. Australia's oldest university. (6)
23. Destroys documents. (6)
24. Room devoted to recording. (6)
28. Component of vintage radio. (5)
29. Physicist noted for atomic theory. (4)
30. Source of UV, etc. (4)

SOLUTION FOR NOVEMBER



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Merry Christmas from all at Jaycar

TAKE ADVANTAGE OF THESE CHRISTMAS SPECIALS!

ABSOLUTE BARGAIN!

SCOPE PROGRAMMABLE ALARM PANEL SENSATION

6 SECTOR CONTROL PANEL

This alarm panel has 6 separate sectors plus 6 x 24 hour sectors, 7 segment display on the panel to show sector conditions and system information. There is also a 12 digit keypad on the front panel. Supplied with a comprehensive 114 page installation/service manual which covers everything you will ever need to know. Power supply to suit 16V AC, Cat MP-3021 $22.50. 12V 1.2Ah gel battery to suit, Cat SB-2480 $20.
Cat LA-5180

Don't pay $399 elsewhere

Normally $199.50

Christmas price

$149.50

SAVE $50

YOU WOULD BE CRAZY TO MISS THIS SPECIAL

LAMINATOR

Price breakthrough! Below $100!

Up until now, if you wanted to purchase a laminating machine to laminate business cards, it would cost you upwards of $400. Jaycar is proud to announce the arrival of our own direct imported laminator that will not only do business cards, it will also laminate photographs as well. It's so simple to use, you can protect and preserve your favourite photos (up to 4" x 6") (100 x 150mm), business cards, recipes, membership cards etc. Operates on 240V AC. Will heat up in 2-3 minutes. Come into any store for a demo.Cat XL-2500

"GREAT CHRISTMAS GIFT"

Only $99.95 NEW

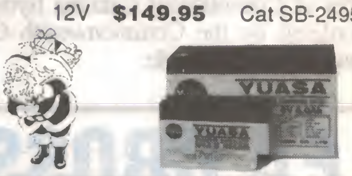
Laminating cards available.

Business card size	Photo size
95 x 57mm Pkt 100	156 x 112mm Pkt 24
Cat XL-2504	Cat XL-2505
$19.95	**$12.95**

JAYCAR NOW STOCKS ALL YOUR SEAL LEAD ACID GEL BATTERY NEEDS

STOCK UP NOW AT THESE CRAZY CHRISTMAS PRICES

1A	6V	**$8.95**	Cat SB-2479
6Ah	6V	**$14.95**	Cat SB-2477
8A	6V	**$16.95**	Cat SB-2478
800mA	12V	**$16.95**	Cat SB-2482
1.2A	12V	**$20.00**	Cat SB-2480
2.4A	12V	**$29.95**	Cat SB-2483
2.7A	12V	**$32.95**	Cat SB-2484
6.5A	12V	**$43.50**	Cat SB-2486
24A	12V	**$99.95**	Cat SB-2492
38A	12V	**$149.95**	Cat SB-2495



JAYCAR HAS MOVED

from 115 Parramatta Road Concord to

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Larger warehouse and full showroom

NEW PHONE NUMBER

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NEW FAX NUMBER

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ORDER LINE

008 022 888

5" DUAL IMPEDANCE SPEAKER

4 Ohms and 8 Ohms Cat AS-3010

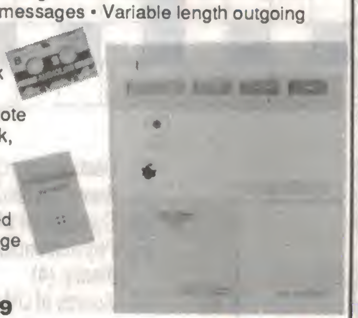
Normally $8.95

Christmas price

$5 SAVE $3.95

TELEPHONE ANSWERING MACHINE WITH REMOTE

Audioline 850 • Full logic micro-cassette deck • Record up to 50 incoming messages • Variable length outgoing message • Memo record facility
• Rewind play back and fast forward
• Full function remote control for playback, reset, save and outgoing message change
• Telecom approved
• 12 month exchange guarantee
Cat YT-7025



Normally $139

Christmas price $129

SAVE $10

MINI VACUUM ATTACHMENT KIT

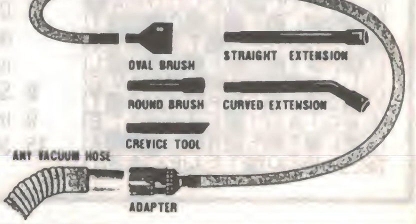
There are so many different mini vacuum cleaners on the market, most of them are expensive and don't really work all that effectively. This unique product simply plugs into the end of your existing house hold vacuum cleaner hose and away you go. Supplied with:

- an adaptor to suit all vacuum cleaner hoses NEW
- 1 x 80cm clear flexible tubing
- 1 x straight and curved extension pipe
- 1 x oval brush
- 1 x round brush
- 1 x crevice tool.

Great for cleaning computers, typewriters, office machines, stereo and video equipment etc.
Cat XV-5060

ALL THIS FOR ONLY $14.95

ATTRACTIVELY GIFT BOXED



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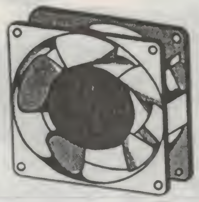
FAN BARGAIN

Another scoop bargain. This time its quality Sunon brand 80mm (31/2") 115V AC fans. Yes, they are 115V, not 240V, but use two 115V units connected in series on 240V. And you can buy two of these for less than one 240V unit and get double the exhaust volume.



Details -
Brand: Sunon
Model: SF 11580A
Voltage: 115V AC 50/60Hz
Current: 0.13 amp
Size: 80 x 80 x 38mm
impedance protected
Cat YX-2520

UNDER HALF PRICE

$10 Each

CIGARETTE LIGHTER POWER LEAD BARGAIN

Ideal for running a 12 volt appliance from your cigarette lighter. Consists of a fused cigarette lighter plug with 1.4mt of cable terminated to a 2.5mm DC plug. Includes 2A fuse. Cat PP-2008

Was $3.95
Christmas price $2.00 SAVE $1.95

UHF ANTENNA PRICES SLASHED

We were sick and tired of paying too much for antennas. We have found our own supplier and can now reduce the prices by up to 45%. But don't worry, the new ones are imported but so were the ones they replaced. New everyday low prices. Wholesale enquiries: phone (02) 747-2022.

43 Element

Specs - Gain: 13dB, Channels: 21-69, Frequ: 470-862mHz, Boom: 20mm square, Overall length: 1234mm, Finish: elements and boom anodised.
Cat LT-3181

SAVE 45%

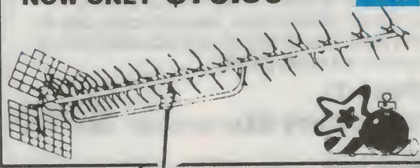
Was $89.50
NOW ONLY $49.50

91 Element

Specs - Gain: 15-19dB, Channels: 21-69, Frequency: 470-862mHz, Boom: 20mm square, Overal length 2214mm, Finish: elements and boom anodised.
Cat LT-3182

SAVE 43%

Was $139
NOW ONLY $79.50



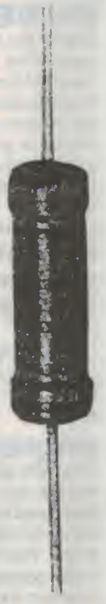
MASTHEAD AMPLIFIER KIT

Refer Silicon Chip Aug 91.
This masthead amplifier kit is easy to build install. It will give around 18dB of gain from 40MHz to 1GHz which is right across the UHF and VHF bands plus FM band (88-108MHz) as well. The Jaycar kit includes the special 24V AC power supply. Beware of other kits which don't supply this. Also includes PCB, jiffy box, mast clamp, OM 350 and all specified components.

Cat KC-5097
$44.95

THE ULTIMATE RESISTOR PACK

That's exactly what this pack is - The Ultimate
This pack gives you every resistor in the E48 range from 0.5 ohm to 9.1 Meg. The E48 range goes like this:
10, 11,12, 13, 15, 16, 18, 20, 22, 24, 27, 20, 33, 36, 39, 43, 47, 51, etc
So, you get 10 of every value, a total of 170 values, 1700 resistors in all and they are bandoleered for easy sorting.
The resistors!
They are top quality, guaranteed 1/4 watt 5% miniature sized. In fact they look like 1/8W they are so small.
Buy this pack and you will NEVER be short of any resistor again.
To buy all these resistors on an individual basis (i.e. 5¢ ea) it would cost you $85. This pack costs well under 1/2 that price and there is a limited quantity.
Cat. RR-2000



ONLY $29.95
Less than 2¢ ea

SMOKE DETECTOR

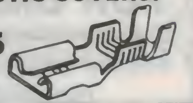
Every year many people die from smoke inhalation caused during minor home fires. Most of these deaths could have been prevented if a smoke detector had been installed. This unit is a self contained detector and operates from a 9V battery. Simply install the battery - attach it to the ceiling and forget about it. It will start beeping when the battery requires replacing (battery life approx 1 year with alkaline battery). Features:

- Ionisation sensor to warn of smoke and fire even before flames are visible
- Extra loud warning horn penetrates closed doors
- Installs in minutes • Self contained
- Built-in test button • Audible beep to indicate low battery
- Size 125mm diameter x 45mm deep

Cat. LA-5090 **$19.95**

SPADE LUG MADNESS

Stock up now. This bargain won't last!
StandardOC 6.3mm spade lugs.
50 MALE, 50 FEMALE, 50 PLASTIC COVERS.
Cat PT-4510
$8.95



CHRISTMAS OFFER

Buy a Portasol butane soldering iron (Cat TS-1420 at $39.95) or Portasol professional pack (Cat TS-1425 at $74.95) and receive **absolutely FREE** one 150g can of Portasol gas valued at $6.50

The incredible "FLYING DUCK" indoor antenna

This brand new design concept indoor antenna will pick up almost anything. It's easily adjusted for either horizontal or verticle polarisation - just turn it around. Supplied with 3 metres of coax and a standard 75Ω TV plug and 12 velcro sticky pads for mounting the antenna on a wall or window. AM/FM/VHF and UHF, frequency range is 100MHz - 960MHz
Cat LT-3135

SAVE $8

Normally $37.95
Christmas price $29.95

NEVER TO BE REPEATED OFFER
75Ω AIR SPACED COAX AT $35 100M ROLL

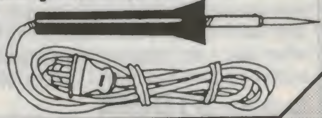
Yes, that's correct. High quality Benelec brand 0.65mm conductor, air space PE dielectric foil shield, 5mm OD sheath, brown in colour. Save a fortune over normal prices. 70¢ a metre for quantities less than 100 metre roll. Cat WB-2002

$35 per 100 metre roll

JAYCAR SOLDERING IRON

Ideal for the hobbyist and handyman. Our lowest price 240 volt quality iron has a stainless steel barrel. 25 watt. Cat. TS-1450

NORMALLY $16.95
Christmas price $12.95 SAVE $4



12 V FUSED LEAD

It's a 1.4ml length of twin fig 8 polarised cable with a line fuse holder and a 2A 3AG fuse. Ideal for running a 12V piece of equipment from the car with the added bonus of being fused. A fuseholder on a 300mm single wire without a fuse sells for $1.10. So stock up now!
Cat SZ-2014

ONLY $1 EACH

Bankstown & Paramatta stores NOW OPEN SUNDAYS 10am - 4pm

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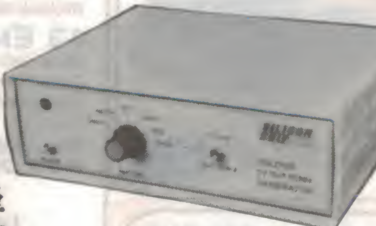
NEW KITS

COLOUR TV PATTERN GENERATOR KIT

Ref: Silicon Chip November 1991
This new colour TV pattern generator produces seven separate patterns: checkerboard, crosshatch, dot, greyscale, white raster, red raster and colour bars. It will enable you to set your TV's convergence and purity for the best possible picture. The Jaycar kit includes PCB punched and screened front panel, modulator and all specified components. 12V AC plugpack not supplied Cat. MP-3020 $16.95

Cat. KC-5103 **$110**



BATTERY CHARGER KIT FOR SOLAR PANELS

Ref: Silicon Chip November 1991
A Jaycar homegrown kit. If you need to operate any equipment from solar power, you will need a charger. This unit will stepdown the voltage to the batteries when the solar panels put out more than 15V and stepup the voltage when there is less than 12 volts available. Will work with any solar panel regardless of wattage, but kit will limit current to 2 amps which is equivalent to around a 25 watt panel. Kit includes PCB, potcores, heatsink and all specified components.

Cat. KC-5102 **$34.95**

STUDIO 3-55L SPEAKER KIT

Refer SC Sept 1991. At last, a high quality speaker kit at a very reasonable price using quality components. Jaycar and Silicon Chip proudly announce the 3-55L 3 way speaker kit. The kit incorporates the Magnavox 12W, 12" woofer, sealed 5" midrange driver and the fabulous Philips AD11610/T8 dome tweeter. Power handling is 80 watts programme. Drop into any Jaycar store for a demonstration (not Rhodes). The kit is available in two parts. Part one includes the drivers, crossovers, terminals, faders, innerbond, screws, cable etc. Part two includes the two fully build black cabinets with all holes cut and speaker grill fitted.

Part 1:
Speakers etc Cat CS-2480 **$279**

Part 2:
Cabinets Cat CS-2482 **$250**

TOTAL $529

BUY BOTH TOGETHER FOR ONLY $499

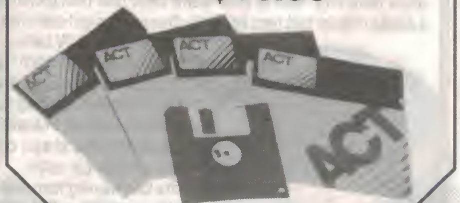
QUALITY DISCS AT SILLY PRICES

5 1/4" DSDD
Cat. XC-4730 **$5.50 pkt 10**

5 1/4" DSHD
Cat. XC-4732 **$10.50 pkt 10**

3 1/2" DSDD
Cat. XC-4736 **$9.75 pkt 10**

3 1/2" DSHD
Cat. XC-4738 **Was $23.95**
NOW $18.50 pkt 10



Grinder/Mini Drill/Engraver

One of the most powerful small tools we have seen! This unit fits neatly into the palm of your hand (110mm long), yet it's powerful 12V DC motor enables you to drill PCBs up to 2mm ø. It can also be used as an engraver as well as a miniature grinder. The unit is supplied with 2 grinding wheels, one engraving burr, a 10mm HS steel PCB drill and 2 brass collet chucks. A 9-18V DC, 1-2A power source is required.
Cat. TD-2485

Fantastic value at $24.95

'Throw away' mini engraver

This very powerful but low cost dedicated engraver has a 1.8mm ø ball-head burr interference fitted onto the motor drive shaft. We have engraved literally dozens of metal objects with this tool and the burr seems as sharp as ever! Obviously a quality HS steel bit. Once the burr wears out, however, it may be difficult to replace the bit, so we are calling it a 'throw away' engraver. We must emphasise that the fitted burr may be able to be removed and replaced but we can't guarantee it. Who cares anyway at this price. This engraver will probably last a normal user lifetime! Requires 12V DC at 1-2A.

Cat TD-2480 **Only $16.95**

Metex digital multimeter with computer interface

Yes, the Metex M3650CR will interface with your computer via RS-232. Connecting lead and software disk supplied. Monitor store and print out the output of the DMM on computer. It will take readings over time and find and hold minimum and hold maximum readings. Plus:

- Eargraph
- Frequency
- Transistor
- Logic
- Relative offset
- 3.5 digit
- 20 Amp current
- Carry case
- Overload indicator
- Data hold
- Minimum/maximum hold
- Diode and continuity
- Range selector beeper

Cat QM-1450
$199.50

Turn your surplus stock into cash!!

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise.
Call Mark Harris or Bruce Routley now on (02) 743 5222

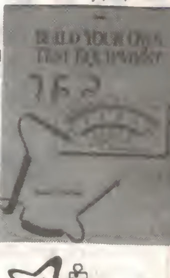
240V RELAY BARGAIN

Don't miss this one. SPST 240V AC 30A relay. It will switch a massive 7500 watts. Spade lug terminals. Clear case.
Cat SY-4075

Normally $16.95
CHRISTMAS PRICE $9.95
SAVE $7

BUILD YOUR OWN TEST EQUIPMENT

By H Davidson.
This book tells you about constructing inexpensive, high capacity troubleshooting equipment for almost any purpose by designing PC boards, substituting components, building and testing components and putting your completed instruments to work. With these you can then troubleshoot televisions, stereos, computers, CD players, Ham radios, microwave ovens, camcorders, electric mirrors, power supplies and cables plus much more. 286 pages, softcover, 232 x 186mm.



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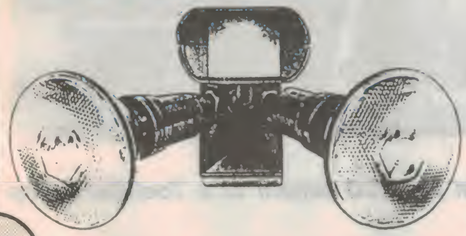

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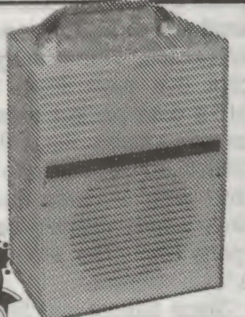

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USING YOUR COMPUTER TO CONTROL RADIO GEAR - 2

A few months ago, we described some ways to make a personal computer take control of a radio receiver or transceiver, using the AOR AR-3000 wideband scanner/receiver as an example and with some software written in BASIC. This month it's Icom's turn, with software written mostly in the C language.

by TOM MOFFAT, VK7TM

Icom uses a computer control system called 'CI-V', right across its current range of radio gear. This must be the most advanced and elegant system in use today; it allows a group of Icom radios to be 'networked' together with a computer, with all of them interconnected by one single strand of shielded wire.

As for the 'C' computer language, don't let its 'difficult' reputation scare you off. It is really the ideal language for controlling things outside the computer, very advanced and elegant like the Icom communications system itself.

C is 'hard' because a clever programmer can make a tiny chunk of code do a lot of work. For instance, one program statement can cause an operation to happen and then look at the result of that operation, all in one hit. I've tried to avoid some of the really obscure techniques in the software presented here.

The 'Bigchars' program as it looks on the LCD screen of a Toshiba laptop computer.

The control circuit

There are 10 functions in Icom's bag of computer-control tricks, although one could expect this to grow with future designs. You can set frequencies, modes, and memories, and read them all back. Two Icom radios can even talk to each other without any computer at all. How do they do this over one little piece of wire?

Serial data is the answer — eight-bit bytes of information sent one bit at a time. A group of bytes becomes a 'packet', which is a complete command to the radio, or a response from it. From a hardware point of view, it's just a series of high and low voltages being impressed on the communications line; in Icom's case they are TTL levels, at +5 and 0 volts. For a 10-byte data packet, that would be 80 data bits sent, along with start and stop pulses for each byte in the 'teletype' tradition. That's 100 pulses in all.

With only one signal line interconnecting the radio (or radios) and the computer, it's obvious that only one party can send at a time. The rest have to be quiet and listen. This usually works OK, except that most Icom radios can send off a data packet unannounced when anyone touches the dial knob or a mode switch. In this case the radio will 'burst into song' — even though some other device may already be sending on the 'party line'. This produces what's called a 'data collision'.

Since talking and listening take place on the same piece of wire, the radios' data transmit and data receive circuits are tied together internally. So the receiver automatically sees everything sent out by the transmitter. If some external influence jiggles the communication line as well, the receiving part of the radio will see a garbled version of what it's sending — a data collision.

When the interference finally stops, the radio unleashes a 'jammer code' of five bytes of hexidecimal 'FC'. What it's really saying is "You guys out there shut up! I'm trying to say something!". With the other radios thus chastised, the original radio tries again.

For a personal computer to join in on this gabfest, it faces the same problem as the radio — it has to combine its data transmit and data receive signals onto one line, at TTL levels. You can buy a special interface from Icom to do this (at around $180) or you can make one yourself. The circuit described here is much smaller than the Icom unit, fitting on a circuit board only 25 x 41mm, and it doesn't even need a power supply. It takes its power from some unused control lines on the computer's RS-232 serial port.

The circuit must translate between the RS-232 voltage levels (nominally +10V and -10V) expected by the computer, and the TTL levels expected by the radio. And it has to do this in both directions. The job is done by a BC547 transistor and a cheap 741 op-amp, with a zener diode and a handful of other bits.

RS-232 data coming from the computer's TXD pin, swinging between -10V and +10V, is converted to the radio's nominal +5V and 0V by transistor Q1 working as a simple switch. When TXD is negative, Q1 is off and the radio's control line is pulled high by resistor R3 — with zener Z1 clamping its rise to around 4.7V. Diode D4 protects the transistor's base from the negative swing. When the TXD line swings positive, Q1 conducts and pulls the radio line down to 0V.

The 741 op-amp does the translation in the reverse direction. Here the op-amp is wired as a simple comparator, comparing the voltage level coming out of the Icom with a reference voltage of around +2V — the voltage drop across three series-connected 1N914 diodes (D1-D3), fed with current from the +10V line via R1. When the Icom line is at +5V (i.e., above 2V), the 741's output swings smartly negative — to around -9V; conversely when the Icom line drops to 0V (and hence below 2V), the 741 output snaps up to +9V or so.

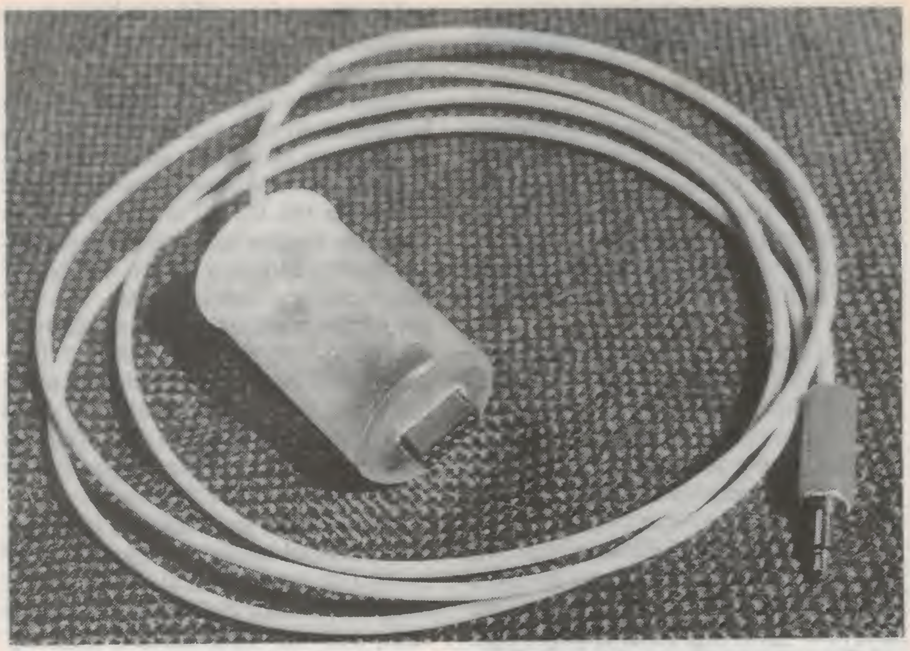
As you can see, the +10V power is 'pinched' from the computer's RTS handshaking line, and the -10V from its DTR line. Although this arrangement is a bit unconventional (nothing I design ever seems to be conventional) it seems to be pretty foolproof. I've tried it on several laptops and several desktop computers of various makes, and it's worked fine each time. But somewhere there might be a computer that it mightn't work with — like old Microbees, for example, that don't produce any negative voltage at all; they swing between +10 or so and zero volts.

I can't guarantee that this little circuit would work with these, so perhaps you'd better see what voltage swing comes out of the TXD line of your computer's RS-232 interface before going ahead with this project.

Note that the project is NOT restricted to IBM-PC computers. It should be useful with any machine that can come up with reasonable positive and negative RS-232 voltage levels.

This should open the door to all kinds of things, like CP/M machines and Commodores and Apples with the right cards fitted. As for software, the assembly language drivers listed below are IBM specific, but you should be able to hack the C stuff around to make it work with just about any implementation.

If you decide to take the plunge, here's the easy way to do it. The project is available as a kit, consisting of a nice fibreglass circuit board, a PCB mounting nine-pin RS-232 connector, and all the



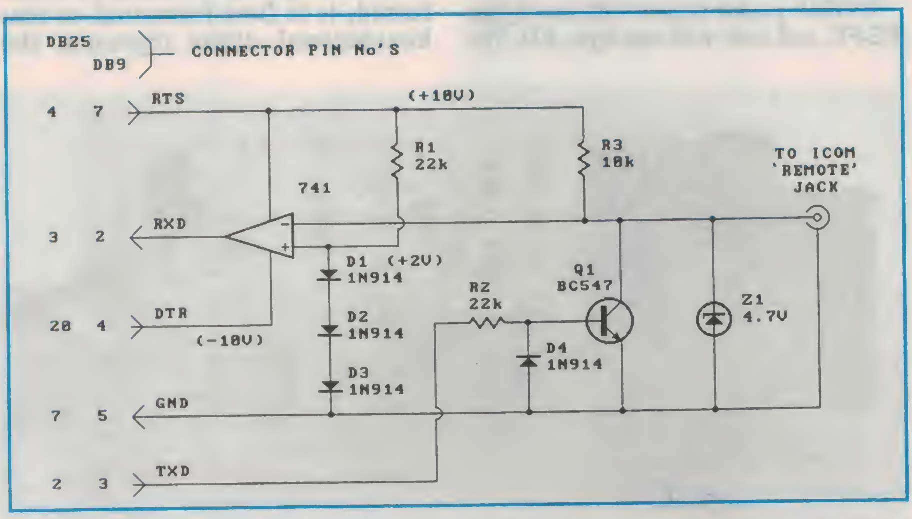
The author's prototype of the computer to Icom interface, built in a 35mm film container. Note the filing down of the plastic DB-9 connector.

PCB parts. If you do some surgery on the connector and cut its mounting ears off, the whole project will fit into one of those 35mm film canisters as per the Vero-board prototype in the photographs. So you plug the canister into the computer, and the other end of the cable into the radio, and you're away! No other wires required.

If your computer has a 25 pin RS-232 connector instead on a nine pin version, you can purchase an inexpensive adaptor, or better yet, make one. Pin numbers for both types of connector, DB25 and DB9, are given on the left of the circuit diagram.

Just use a five-wire cable to join the pin numbers: pin 4 of the DB25 to pin 7 of the DB9, etc. The kit has been specially designed to make life easier for first time builders. For instance, the TO-92 transistor shape provided by the Protel Easytrax PCB drawing package is small and fiddly, designed for tight packing of components in the hands of a professional technician.

I've redesigned the standard 'Easytrax' TO-92 transistor shape to have nice big copper pads, well spaced apart. As well I've made all the tracks as large as possible, so first-timers building the kit will find it a snap instead of a sizzle. Kit ordering information is at the end of this article.



Here's the schematic for the interface, which as you can see uses only a handful of parts. Operating power is 'pinched' from the computer via the RTS (+10V) and DTR (-10V) handshaking lines of the RS232 serial port.

PC controlled radio

Building the kit

This is really a very simple procedure, and it should take only a few minutes to complete the circuit board. Insert the resistors first, and then the diodes. Make sure the diodes are orientated so that the band on the diode body matches the band on the overlay shape. Then add the transistors.

If you intend to house the interface in a 35mm film container, you must first remove the mounting 'ears' from the DB9 connector so it will fit into the canister. Use a hacksaw (carefully), a file, and/or sidecutters. Then install the connector onto the circuit board.

At the other end of the board are two large pads maked + and -. The + pad goes to the 'hot' side of the cable going to the radio; the - goes to ground. Finally install a 3.5mm connector on the end of the cable. Fitting the board into a film container will require a hole in the lid for the cable, and another hole to be cut for the plug to come through. The container plastic is quite soft and a sharp knife and/or file will do the job. You may have to round the edges of the circuit board slightly to make it fit your particular container.

Icom's data format

Icom radios expect to have their computer control data packets formatted in a way that must be followed exactly, or the system won't work. Since an eight-bit byte is most easily described as two hexidecimal digits, that's what we'll use here. In the C language, values starting with '0x' are hex.

EVERY packet begins with two bytes, FE-FE, and ends with one byte, FD. The radio interprets everything in between as a command. Messages coming back from the radio have these bytes as well.

Since many radios and computers can be hooked up on the same 'party line', it is necessary to identify which device is sending, and which device the message is for. After the FE-FE come two more bytes, the number (address) of the receiving device, followed by the number of the sending device. An IC-735 transceiver is always known as 'address' 04, unless you physically change it by getting into the radio and snipping some jumpers. Similarly the new IC-R72 receiver has an address of '50'. You can assign any address to the computer; I've chosen number 00 for this project.

Following the two addresses is the actual command number, ranging from 00 to 0A (10 possibilities). If it's just a simple command that doesn't exchange data, such as 'activate the memory system', the final FD is stuck on after the command number, and that's it. Six bytes to send the command: FE-FE-04-00-08(the MEMO command)- FD.

If the radio is not asked to return data (such as its frequency or mode), it will respond with a very similar packet: FE-FE-00- 04-??-FD. Note that the sending and receiving addresses are reversed since it's now the radio doing the sending. In the position where the command would go, now shown as ??, the radio returns a code: FB (fine business) if the command was accepted, FA (as in 'sweet...') if the command was a dud, and FC if there was a data collision. As detailed below, I have commandeered the code FF to indicate that the whole communications system has gone kerflooie.

When frequency data is to be transferred, it is first formatted so that hexidecimal digits represent the numerals of the frequency. That is, the frequency '12345.67kHz' is formatted as 70-56-34-12 in hex. If you skip along backwards through this, the numerals are 12345670. The radio only tunes in steps of 10Hz, so the last digit is just a dummy, forced to zero.

Note that the four bytes can only hold frequencies up to 99999.99kHz. So for 100000.00kHz and above (100MHz) a fifth byte is needed. With two more digits available we can now send frequencies up to 9999MHz (don't laugh, it will come!). Icom are now allowing for this. The IC-735 uses four frequency bytes, but newer radios and VHF sets use five bytes. Some can be set up either way with internal DIP switches or jumper snipping. Our 'sendfreq' software routine can handle either four or five bytes.

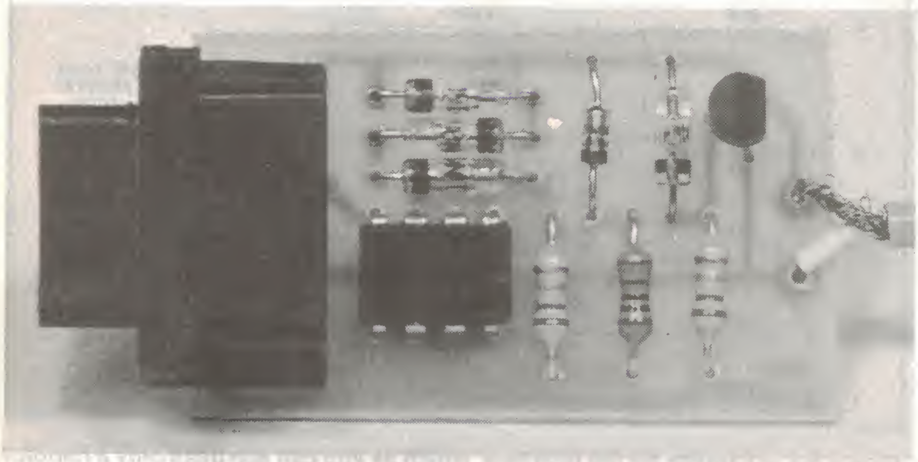
As for modes, they are exchanged as a simple number, ranging from 00 for LSB through 05 for FM. Although the IC-735 doesn't have a special RTTY mode, sending it mode 04 will cause the display to show 'RTTY' and the radio then goes dead. There must have been a plan for future expansion...

The software

First some quick grounding on the C language. Most 'things' you want to do are written as 'functions' (also called *procedures*, in Pascal). A function is just a tool. You put something in one end and something else comes out the other. In these applications you might put a number in one end of a function and it comes out the other end of the communication line as a new frequency in the radio. Or it might go the other way: 'getfreq' sucks the current frequency out of the radio and hands it to you as a nicely formatted ASCII string.

One reason that C is such a handy language is that once a function is written and got working, it can be used in some other program without modification. In this article you'll find functions to send and receive frequencies and modes to and from Icom radios. You can certainly pinch them to use in some other computer control program you may write for yourself. Be my guest!

In the program listings, you'll see functions presented as a function name, followed by parentheses: name(). If there's something inside the parentheses, that is data we are feeding into the function. If the function is shown assigned to something — e.g., x=name() — we are using x to collect what comes out of the function. Below the function name comes the 'body' of the function, the code that makes it up, with the whole works enclosed in curly braces {}. There



A closeup of the Icom interface, with the slimmed-down DB-9 socket on the left, and the shielded lead for the receiver connection on the right.

The author's prototype of the computer to Icom interface, shown here connected to the COM1 port of a Toshiba laptop computer.

may be other curly braces {within the curly braces} — i.e., 'nested'.

C functions can be written in the language itself, or (the good part) in some other language or directly in microprocessor machine code. Using the microprocessor to deal directly with the computer's hardware, we can virtually redesign the computer for our own purposes. The listing RS232.A shows how it's done.

The normal IBM-PC communications routines certainly don't expect to see everything going out on the send line coming right back on the receive line, and if this is allowed to happen the computer will find itself in considerable strife. So in these applications we have completely shunted around the stupid old computer and gone straight for its UART chip (Universal Asynchronous Receiver/Transmitter).

Many *Electronics Australia* projects over the years have used UARTs. We're doing the same thing — the only difference here is that the UART is already soldered down to your computer's circuit board. The PC's UART is like most others, it has a holding register for an eight-bit byte waiting to be sent, it has a shift register where the byte is shifted out bit-by-bit, it has a receive shift register which does just the opposite, and a receive holding register where the complete received byte waits to be read by the computer. Program RS232.A contains three machine code (assembler language) routines for directly controlling the PC's 8250 UART chip. It's written for the popular DeSmet (PCC) C language compiler, but the same general techniques work with other language packages such as Power C. In the listing, the lower case material is the part that interconnects between the C language and the routine, and the upper case part is the routine itself.

The stuff you see in upper case was originally written and tested as part of a Microsoft assembler program, before use of the C language was even thought of for this project. The code was simply lifted out of the MASM file with a word processor and transferred into the DeSmet C/Assembler format, already tested and working.

You will notice three routines: INITCOM1, SEND, and RECV. INITCOM1 programs the UART chip for the correct baud rate and data format. SEND sends one byte to the radio. RECV collects one byte from the radio. But it ain't quite that simple.

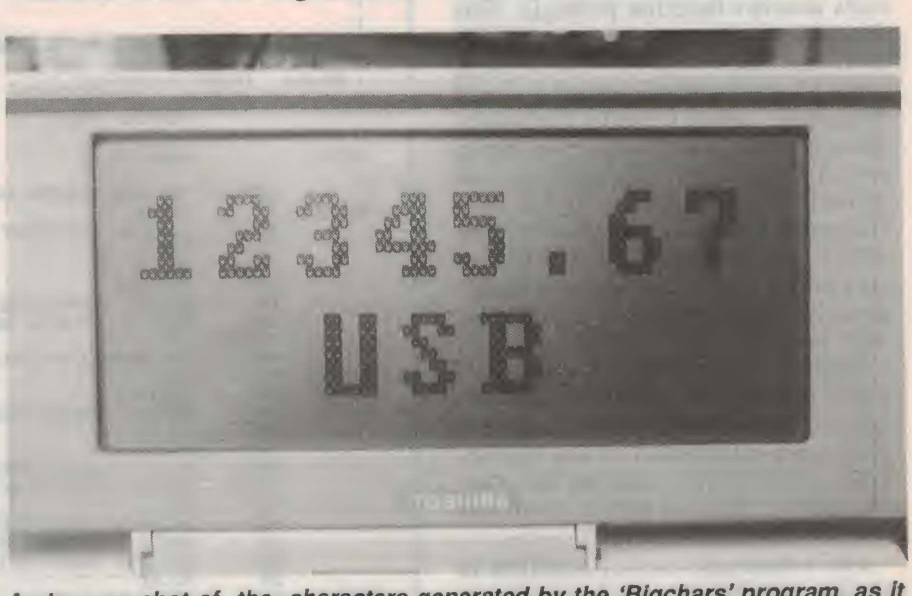
SEND and RECV work together to ensure that there is no way the IBM-PC can try to send and receive at the same time, and thus clog itself up. When the program calls SEND, the routine won't release control of the program until the transmit holding register is empty and all data is in the radio. So the program can't attempt to receive while sending is still taking place.

The RECV routine is a little more complicated. It checks again that the transmitter is not sending, and then immediately clears the receiver holding register of anything that might have come in before the RECV routine was called (such as leftovers from the transmit line). Then it starts looking for a byte, expecting the radio to send one.

If nothing happens in two or three seconds (depending on your computer's clock speed), the routine gives up and delivers hexidecimal FF back to the computer. (FF is a code never used in the Icom scheme of things). The computer then knows there's been a communications failure, usually caused by forgetting to plug in the interface.

The DeSmet assembler turns the assembly file into an 'object' file, RS232.O. This is linked with the object file from the C compiler to produce the actual program. Within the C program itself, a statement like 'x=RECV()' will load variable x with one byte from the radio. 'SEND(x)' will send a byte from variable x to the radio. These function calls are shown in the C listings in UPPER CASE, to make them stand out.

Well that's the guts of it then, we can now exchange data bytes between the depths of the C language and an Icom radio. We KNOW that the computer's



A close up shot of the characters generated by the 'Bigchars' program, as it looks on the LCD screen of a Toshiba laptop computer. As you can see, the characters have been made up of 'smiley' faces.

data receiver will never see a transmitted byte, and we KNOW that data will come into the computer only when we open the door by calling the RECV routine. We can ignore anything else. Let's see how it works in practice:

The SENDICOM program

This little program lets you type a frequency or mode on your keyboard, and send it to an IC-735. The program will work without change for at least two versions of the C language, Power C and DeSmet C. Getting it working with others should be a cinch.

You type the name SENDICOM followed by a frequency in kHz), with or without a decimal, or a mode name (USB, LSB etc.) or both. If the program sees digits it sends them as a frequency, or if it sees letters, it assumes they describe a mode. It's not choosy about command line entries, so if you type something like 'sendicom am fm am fm am fm am fm' you can drive the radio's display wild.

The function sendfreq(freq,bytes) needs two pieces of information to work: a frequency as a simple text string ('12345.67'), and the number 4 or 5, telling it how many bytes to send.

The main part of the program collects the frequency from the command line, and specifies four bytes for the IC-735. Sendfreq first takes account of any decimal point and then formats the frequency into a temporary storage buffer as '12345670'.

When the buffer is ready, sendfreq then calls another function prolog(). This function simply sends the bytes FE-FE-04-00 and then returns. Next sendfreq sends 05, the command number for 'send frequency'. Next it works backwards through the frequency buffer, picking up two digits at a time — 70, 56, 34, and 12.Each two digits have 30 hex subtracted from them to convert from ASCII, and then they're shoved next to each other into one byte which is sent to the radio. Then comes the end-of-message byte, FD.

Finally setfreq calls a function verify() which receives six bytes back from the radio. If the fifth one isn't FB it grizzles about 'data not accepted'. If any byte appears as FF, verify assumes the communications link has broken down and exits the program forthwith.

The sendmode(mode) function is similar, but simpler. It is handed a text string (mode) from the command line, which it checks against a table of modes

```
; Half-duplex RS232 routines for PCCA (DeSmet C) Assembler.
; Direct hardware access, no BIOS routines. Mostly for receiver control.
;
        CSEG
;
; Init RS232 for COM1 with BX = baud rate, CX = control, DX = modem.
; Usage:  inticom1(bauds, control, modem);
;
                public initcom1_
;
initcom1_:      push    bp              ; save from bios
                mov     bp,sp
                mov     bx,[bp+4]       ; baud rate
                mov     cx,[bp+6]       ; control reg.
                mov     dx,[bp+8]       ; modem control reg.
;
        MOV     AL,DL
        MOV     DX,3FCh ;MODEM CONTROL REGISTER
        OUT     DX,AL
        MOV     DX,3FBh ;CONTROL REGISTER
        MOV     AL,80h
        OUT     DX,AL   ;SELECT BAUD RATE DIVISOR
        MOV     DX,1    ;DX AND AX MAKE DOURLE-WORD CONTAINING 115200D.
        MOV     AX,0C200h
        DIV     BX
        MOV     DX,3F8h ;LSB
        OUT     DX,AL   ;WRITE LSB
        MOV     DX,3F9h ;MSB
        MOV     AL,AH
        OUT     DX,AL   ;WRITE MSB
        MOV     DX,3FBh ;CONTROL REGISTER
        MOV     AL,CL   ;PARITY, STOP, AND DATA BITS
        AND     AL,7Fh  ;PREVENT BIT 7, WRITING TO BAUD RATE DIVISOR
        OUT     DX,AL
        MOV     DX,3F9h ;INTERRUPT ENABLE REGISTER
        MOV     AL,0    ;KILL ALL UART INTERRUPTS
        OUT     DX,AL
;
                pop     bp
                ret
;
;
; Send the byte in AL.
; Usage:  send(outbyte);
;
                public  send_
;
send_:          push    bp
                mov     bp,sp
                mov     al,[bp+4]       ; byte to send
;
        MOV     DX,3FDh ;STATUS REGISTER
        PUSH    AX
SEND1:  IN      AL,DX
        TEST    AL,20h  ;TX HOLDING REGISTER EMPTY?
        JZ      SEND1   ;IF NOT EMPTY
        POP     AX
        MOV     DX,3F8h ;TX HOLDING REGISTER
        OUT     DX,AL
;
                pop     bp
                ret
;
;
; Receive a character into AL. Times out after a few seconds if nothing
; received, then returns "FF".
; Usage:  inbyte = recv();
;
                public  recv_
;
recv_:          push    bp              ;save the registers
;
        MOV     DX,3FDh ;STATUS REGISTER
RECV1:  IN      AL,DX
        TEST    AL,40h  ;TX SHIFT REG EMPTY?
        JZ      RECV1
        PUSH    DX                      ;1
        MOV     DX,3F8h
        IN      AL,DX   ;PURGE RECEIVER REGISTER
        POP     DX      ;STATUS REGISTER ;1
        PUSH    CX                      ;1
        MOV     CX,1000h;1000h TRIES BEFORE TIMEOUT
RECV2:  PUSH    CX                      ;2
        MOV     CX,100h
HERE:   LOOP    HERE    ;WASTE SOME TIME
        POP     CX                      ;2
        IN      AL,DX
        AND     AL,1    ;CHARACTER RECEIVED?
        LOOPZ   RECV2   ;IF CX<>0 AND BIT 0 OF AL = 0
        POP     CX                      ;1
        MOV     AL,0FFh ;IF TIMEOUT
        JZ      RECV3   ;IF NO CHARACTER RECEIVED
        MOV     DX,3F8h ;RECEIVE DATA REGISTER
        IN      AL,DX
RECV3:  MOV     AH,0
;
                pop     bp
                ret
```

SENDICOM.C

```c
/* Sends frequency and mode from command line WORKS Thu 11-22-1990 */
/* Added five-bytes frequency capability, Mon 11-26-1990 */

#define strchr index /* for DeSmet C / Power-C compatibility */
#define test 0

main(howmany, cmdline)
    int howmany;
    char *cmdline[];
{
    int i, j, digit;
    if (howmany>1)
    {

#if ! test
        INITCOM1(1200,3,2); /* 1200 bauds, 8 bits, no parity, RTS on */
#endif

        for (i=1; i<howmany; i++) /* for each command line entry */
        {
            digit=0; for (j=0; j<strlen(cmdline[i]); j++) /* mode or freq? */
            {
                if ((isdigit(cmdline[i][j]) | cmdline[i][j]=='.')) digit=1;
            }
            if (digit) sendfreq(cmdline[i],4); else sendmode(cmdline[i]);

    #if test
            puts("\n"); /* for screen only */
    #endif

        }
    }
    else puts("Usage: SENDICOM <freq[KHz]> <mode>.\n");
}

sendfreq(freq,bytes) /* Sends a frequency from an ASCII string */
    char *freq;
    int bytes; /* How many bytes of frequency data, 4 or 5 for Icom */
{
    char buffer[11], *ptr;
    int i, b;

    /* Converts frequency in "freq" and sends it. */

    buffer[0]=0;
    ptr = strchr(freq,'.'); /* scans ptr along "freq" until decimal point */
    if (ptr==0) /* no decimal point */
    {
        i=strlen(freq); /* length of the "whole" part of freq */
        ptr=freq+i; /* points to \0 at end of freq string */
    }
    else
    {
        i=ptr-freq; /* length of whole part */
        ptr++; /* to skip over decimal point */
    }
    b=bytes*2;
    if (i<b-2) /* whole part seven digits or less */
    {
        if (i<b-3) strncat(buffer,"0000000",b-3-i); /* leading zeros */

        if (i>0) strncat(buffer,freq,i); /* whole part */
        strncat(buffer,ptr,2); /* fractional part */
        strncat(buffer,"000",b-strlen(buffer)); /* trailing zeros */
        prolog(); /* send header bytes */
        SEND(5); /* "set frequency" command */

        /* Takes two numerals at a time, starting from right hand end, and
        converts them to one hex byte. "1" and "2" become 12h. Byte then
        sent to radio. */

        for (i=b-2; i>=0; i-=2)
        {
            SEND(buffer[i]-0x30<<4 | buffer[i+1]-0x30&0x1F);
        }
        SEND(0xFD); /* end-of-data */
        verify();
    }
    else puts("Number too big!\n");
}

sendmode(mode) /* Sends a mode from an ASCII string */
    char *mode;
{
    char *modes[6] = {"LSB","USB","AM","CW","RTTY","FM"};
    int i;
    for (i=0; i<strlen(mode); i++) mode[i]=toupper(mode[i]);
    i=0; while ((strcmp(mode,modes[i])!=0) & (i<6)) i++; /* look for match */
    if (i<6)
    {
        prolog();
        SEND(6); /* command for "set mode" */
        SEND(i); /* the mode number 0-5 */
        SEND(0xFD); /* end-of-data */
        verify();
    }
    else puts("Mode not found!\n");
}

prolog()
{
    /* FEFE="attention", 04=destination addr, 00=source addr */
    char prodata[4] = {0xFE,0xFE,4,0};
    int i;
    for (i=0; i<4; i++) /* sends the prolog */
    {
        SEND(prodata[i]);
    }
}

#if test
SEND(x) /* test routine to replace proper RS232 send */
    char x;
{
    printf("%02x ",x);
}
verify()
{
    puts("Verify goes here.\n");
}
#else
verify()
{
    char buffer[6];
    int i;
    for (i=0; i<6; i++)
    {
        buffer[i]=RECV();
        if (buffer[i]==0xFF)
        {
            puts("\nNO RESPONSE FROM RADIO!\n");
            exit(1);
        }
    }
    if (buffer[4] != 0xFB) puts("Data not accepted!\n");
}
#endif
```

BIGCHARS.C

```c
/* "Big Character" freq and mode display, smiley faces as pixels. */

char patterns[128][8]; /* to hold ASCII 0 -> 127 character shapes */
char buffer[8]; /* to hold the formatted frequency "nnnnn.nn" */

main()
{
    char *modes[6] = {"LSB","USB","AM","CW","RTTY","FM"};
    int i, j, row, column;
    _lmove(1024, 0xFA6E, 0xF000, patterns, _showds()); /* chars from rom */
    INITCOM1(1200,3,2); /* 1200 bauds, 8 bits, no parity, RTS on */
    SCR_CLR();
    SCR_CURSOFF();
    while (SCR_CSTS() == 0) /* while no key pressed */
    {
        while (!(i==0xFE & j==0xFE))
        {
        i=RECV();
        j=i; /* looking for "FE-FE" */
        }
        for (i=0; i<4; i++) j=RECV(); /* skip over next three recv bytes */
        if (j==0) /* function number for frequency display */
        {
            getfreq();
            column=4; row=4; /* top half of screen */
            for (i=0; i<8; i++)
            {
                bigchar(buffer[i],row,column+i*9);
            }
        }
        else /* display the mode */
        {
            SCR_ROWCOL(12,0);
            SCR_CLS(); /* clear bottom half of screen only */
            column=25; row=14; /* bottom half of screen */
            j=RECV(); /* get the mode */
            i=0; while (*(modes[j]+i)) /* show the mode char by char */
            {
                bigchar(*(modes[j]+i),row,column+i*9);
                i++;
            }
        }
    }
    SCR_CURSON();
    SCR_ROWCOL(23,0); /* put cursor bottom left of screen to finish */
}

getfreq() /* receives four bytes from radio and formats them into freq */
{
    int i, j;
    char c;
    for (i=0; i<4; i++) /* frequency display built up in "buffer" */
    {
        c=RECV();
        buffer[7-2*i]= (c & 0x0F) + 0x30;
        buffer[6-2*i]= (c >> 4 & 0x0F) + 0x30;
    }
    buffer[7]=buffer[6]; buffer[6]=buffer[5]; buffer[5]='.';
}

bigchar(character, row, column) /* ASCII codes from 0 to 127 */
    char character;
    int row, column;
{
    char buffer[16]; /* to hold 8 (bytes+attributes) for screen */
    int b, i, j;
    row=(row*160)+(column*2);
    for (i=0; i<8; i++)
    {
        b=0x80; /* rotating bit */
        for (j=0; j<16; j+=2)
        {
            if (patterns[character&0x7F][i] & b) buffer[j]=2; /* LIGHT */
            else buffer[j]=0x20; /* DARK */
            buffer[j+1]=7; b = b >> 1; /* "7" is the attribute */
        }
        _lmove(16, buffer, _showds(), row, 0xB800); /* 8 pixels to screen */
        row+=160;
    }
}
```

it knows about (LSB, USB, etc). If the mode is found the routine sends the radio the number of the mode's position in the table starting from 0 (e.g., '3' for CW). Sendmode also uses prolog() and verify().

BIGCHARS program

This one was written as a bit of fun, and to show what Icom radios do when you twiddle their knobs. It produces a big display of the radio's frequency and mode on the computer's screen, made up of 'smiley-face' characters. As you tune the radio, the display ticks over, showing the frequency right down to the 10's of kHz digit (which is more than the radio does). Readers who think they've seen this before are right; I once did a similar thing on the Microbee.

This program is for DeSmet (PCC) C only, because it uses some screen handling routines from an accessory package that comes with that compiler. Similar things will be available in other versions of C under different names, such as clrscrn() in Power C to clear the screen.

The big characters are identical to the normal character set in YOUR computer; in fact their shapes are copied down from the computer's ROM. But where the computer uses dots on the screen to produce characters, this program uses whole characters instead of dots, so the results are BIG! I tried lots of other characters before settling on the smiley face, but it looks the best. The big white square character, for example, looks too 'blocky'.

If you want to play around with other characters, try a number other than 2 in the bigchar() function statement, 'buffer[j]=2'. The bigchar() function, by the way, can be used to produce big screen characters for any application. Feel free to pinch it.

The frequency is read from the radio by the function getfreq(), which does exactly the opposite of what sendfreq() does. It brings four bytes in from the radio and produces a text string in the form '12345.67'. This is reproduced on the top half of the screen by bigchar().

It wasn't really worth producing a getmode function, since all the program has to do is collect a number and point to that number's entry in a table of mode names. Bigchar then displays the name on the bottom half of the screen. The MEMORY program has a proper getmode() function.

But you're not going to see MEMORY here, I'm afraid. it's as big as the two C listings here together, and

(Continued on page 109)

SHORTWAVE LISTENING

by Arthur Cushen, MBE

Interval signals aid station identification

The trend to help listeners identify international shortwave stations is to use an interval signal which is generally based on a national anthem or some familiar national sound. This helps listeners to pin-point the source of the transmission. Of course, Radio Australia is known worldwide for its kookaburra call and 'Waltzing Matilda'.

The use of parts of the national anthem is familiar to listeners of Radio Canada, with a few bars of 'Oh Canada' while Radio France International has a short musical break incorporating 'La Marseillaise'. New Zealand uses its familiar bellbird when opening transmission; Italy has the bird call of a nightingale; Iraq uses the soft chirps of a mechanical nightingale; and South Africa the call of the Bokmaikerie.

The voice of America uses part of 'Yankee Doodle' to identify its programmes, while the BBC has three different signals — the 'Bow bells' for the World Service, the notes B-B-C on the piano for the Foreign Service, and the familiar 'V' sound in Morse for transmissions to Europe. Radio Nederland's Carillon Chimes identify broadcasts from Hilversum, while the first bars of the 'Blue Danube' informs listeners they are tuned to Vienna, Austria.

Many gospel stations use part of a hymn to open their transmission; for instance KTWR Guam uses 'We've a Story to Tell to the Nations' played on an organ, while KSDA Guam uses 'Lift Up the Trumpet' to start its programme. From the Philippines, the Far East Broadcasting Company uses 'We Have Heard the Joyful Sound', while broadcasts from the Indian Ocean station on Seychelles FEBA commences with 'What a Friend We have in Jesus'. From the snowbound station in Alaska, KNLS uses 'Chariots of Fire' to identify their broadcasts, while the Vatican uses the bells of St Peter's in Rome.

Switzerland uses a traditional Swiss-German folk song played on a music box, while Radio Japan also has a music box theme. Radio Moscow has the familiar 'Midnight in Moscow' as one of the signals identifying its transmissions — it also uses the Kremlin Bells and many other musical themes in its various networks. Germany uses a piece by Beethoven played on celeste, while Poland uses part of a Chopin composition. Portugal has a time gong. In the Asian area, India has an interval of eight seconds duration played on violin, cello and tampura, and neighbouring Bangladesh uses a local melody played on violin and tampura.

The most unusual interval signal is from Radio Botswana, which uses cow bells and the sound of farm animals to commence its daily programme. Radio Sweden for many years used the 'Swedish Rhapsody' as its identification sound. This has now been replaced with 'To the Wide Wide World'. Norway uses an ancient folk tune, while Radio Denmark precedes all its broadcasts with the repetition of the first bars of a piece of Danish music.

This is just a brief summary of interval signals which listeners will recognise. The World Radio TV Handbook, in its detailed listing of countries, always incorporates information as to the station identification signal. There are recorded tapes available which include major shortwave stations opening signals.

Many have been supplied by the broadcasters themselves, so you can hear in excellent studio quality the main sounds on shortwave.

New frequencies for VNG

The Australian Time and Frequency Service, which originally operated from Lyndhurst near Melbourne, used 4500, 7500 and 12,000kHz. When the transmitters were moved to Llandilo, NSW, the frequencies of 5000, 10,000 and 15,000kHz were put into service. However they caused some interference to WWV and WWVH operated by the National Bureau of Standards in the US. In recent months, the frequency of 15,000 has been replaced by 16,000kHz, and now an agreement with the Australian Navy has resulted in two new channels being put into operation. These new frequencies are 8638 and 12984kHz. The channels are on loan from the Royal Australian Navy, which previously used them in Darwin.

The frequencies of 5000, 8638, 12,984kHz will operate 24 hours a day, and 16,000kHz from 2200-0500UTC. There will be a morse identification each quarter hour on 8638 and 12984kHz, while voice announcements will be heard on the other two channels. The transmitter power is 10kW and the cost of operating these transmitters is generally from private donations. The new frequencies should give worldwide coverage.

VNG is interested to learn of reception, and reports should be sent to Dr Marion Leiba, VNG Users Consortium, GPO Box 1090, Canberra ACT, 2601, Australia. Return postage should be enclosed.

The future plans of VNG include the use of a talking clock on the two frequencies of 5000 and 16,000kHz.

This identification will be given every minute and will follow the 60 second time pip. At present the technical aspects of including this new facility are being studied; its inclusion would make VNG of even greater value, particularly to radio listeners.

The use of the new 16,000kHz channel has resulted in worldwide reception. Reports have been received by VNG for the first time from the USSR, and many other distant countries, who are receiving the signal on this new frequency. The 16,000kHz frequency is shared between New Zealand and Australia, and as long as VNG only uses 5000 watts on this channel, there is no interference.

VNG used to operate three transmitters, with one standby. Now with the increase to four frequencies, there is no longer a backup available, in the case of a breakdown of one of the units.

This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time.

US reduces services

Following the collapse of the communist governments in Eastern Europe, the US is investigating the Voice of America ouput — the whole of the system is being re-examined. US International Broadcasting takes part in the operation of a number of broadcasting organisations, which include the Voice of America, Radio Free Europe, Radio Liberty, as well as Radio Marti, Radio Free Afghanistan and the Worldwide Television Service. The problem is that there is not enough money to support all these services; there is also a certain amount of overlap. For instance, the VOA and Radio Liberty both broadcast in 17 languages, with a considerable amount of duplication. As well as the budget consideration, there is always a shortage of frequencies. Also the number of countries willing to allow VOA to set up relay bases on their soil has decreased. Add the shortage of broadcasters who are able to carry the programmes in the various languages — it is difficult to find Tibetian, Uzbeck, Georgian people with a journalistic background.

The VOA has a considerable number of broadcasts to Eastern Europe, but is deficient in services to South East Asia, the Middle East and Africa. The VOA relay base in Monrovia, Liberia, was destroyed during the recent civil war in that country. The whole of the transmitter complex was vandalised, and only the towers and feeder lines are intact. This means that VOA has lost its main voice into Central and Southern Africa.

New Canadian station

The North American market is the centre of many broadcasting organisations. The latest to announce plans for that area is the North America Broadcasting Company, which will operate from Manitoba, Canada. The project includes two 250kW transmitters, to be rented to other broadcasters who have difficulty in putting a signal into North America. The station feels there is a growing interest in information, news and programmes heard on shortwave. There seems to be a new interest in shortwave radio in the US, where more professional people and not radio hobbyists are the projected audience. According to a media network report, this growing trend could be met by offering a high quality shortwave service into the area. The new station plans to charge clients $1000 per transmitting hour, which is much higher than many private shortwave broadcasters charge in the US.

The reason for the high cost is that the new transmitters, operating out of Canada, will give a much higher quality signal and a more reliable service in the area.

AROUND THE WORLD

ALBANIA: Radio Tirana has introduced a new interval signal, a new schedule, and its programme service is much more enjoyable than the hard propaganda broadcasts of the past. But there has been a reduction in English transmissions. It broadcasts to North America at 0230-0300 and 0330-0400 on 9580 and 11825kHz. Programmes for Europe are at 1730-1800 on 7155 and 9480kHz; 2130-2200 on 7245 and 9480kHz; while there is one transmission to Africa at 1530-1600 on 9585 and 11835kHz.

BAHRAIN: Broadcasting from the United Arab Emirates has been heard in English for the first time, with a daily transmission at 2000-2105. The contents of the programme are features of the Middle East, with a short news bulletin at 2100. The frequency of 6010kHz is rated at 60kW, according to a submission made recently to the International Telecommunications Union.

ESTONIA: Through Radio Tallinn, Estonia has joined the other Baltic republics Lithuania and Latvia, with a broadcast in English. This is heard at 2030-2100 on Mondays only, on two frequencies 5925 and 9560kHz — the latter channel giving the better reception.

GEORGIA: Another USSR republic with its own external service is Georgia, broadcasting from Tbilisi on a frequency of 12070kHz. It is heard in English at 1700 until 1730, when the programme continues in German. The signal generally suffers from poor readability. Two additional announcements are made at 2000 on 11760kHz, and 0400 on 12050kHz.

ISRAEL: Despite threats of a complete cut in the budget of the Israel Broadcasting Authority, and the ending of External Services KOL, Israel has continued on a very much reduced scale. The broadcasts in English are now to North America at 210-2200 on 11587, 15100, 15640, 17575 and 17685kHz; to Europe at 1700-1715 on 11587, 15640 and 17590kHz; 1900-1930 on 11587, 11605, 11675, 15640, 17630 and 17685kHz; and to the Far East at 1330-1400 on 11587 and 17590kHz.

USA: Station WWCR World Wide Christian Radio in Nashville has added a second 100kW transmitter. The new transmitter is using 7435kHz and has been heard to closing at 0630. The original outlet continues to use 9520 and later 15690kHz on a 24 hours a day basis. Most of the programmes are of a gospel nature, though there are specialised programmes for listeners in Cuba, and for minority groups in the US. WWCR has recently made a change in its mailing address: it is now 4647 Old Hydes Ferry Pike, Nashville TN 37218, USA. ■

Experimenting

Continued from page 70

field produced by the coil attracts a lever, which in turn closes the switch contacts S2. Notice that we have specified a 12V relay even though we are using a 9V battery. Twelve volt relays tend to be cheaper, and will still work quite satisfactorily at 9V. So this saves us some money.

Notice too the diode D1 across the relay. The reason for including this is to protect transistor Q2. When the relay turns off, the magnetic field in the relay coil drops very suddenly, producing quite a large 'back EMF' voltage spike.

This spike can destroy the transistor if that is the only pathway through which it can dissipate. So we provide the diode as an alternative path. The diode may seem to be 'upside down', because its cathode is connected to the positive supply rail.

This is because we don't want current flowing through it under normal conditions — we want the current to flow through the relay. But when the coil is discharging, the diode and coil form their own special circuit to dissipate the spike.

PARTS LIST

Miscellaneous

1 PCB 83x44mm, coded 91DS12
1 9V battery
1 momentary-make pushbutton
1 SPDT 12V mini relay, PCB mounting
1 LED

Resistors

All 1/4W, 5%:
1 220 ohms R1 (red-red-brown)
1 2.7k R2 (red-purple-red)
2 10k R3,R4 (brown-black-orange)
1 1.2k R5 (brown-red-red)

Capacitors

1 470uF 16V PCB-mount electrolytic

Semiconductors

1 1N4002 diode
2 BC548 NPN transistors

Transparencies

A high contrast, actual size transparency (negative) is available for only $2 for anyone wishing to make their own printed circuit board. This special price applies for transparencies for projects in this series only. Write to *EA*'s reader services division.

Happy experimenting — and don't forget to send us your ideas for future circuits. ■

GREAT SIGHTS AND SOUNDS FROM ROD IRVING AND ARISTA

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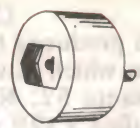
COMPONENTS

NEW



TWO PIN MAINS ADAPTOR

Converts a two pin U.S or European plug into an Australian two pin plug. Designed for use with double insulated appliances
Approval#: N11071
P18012..$4.95

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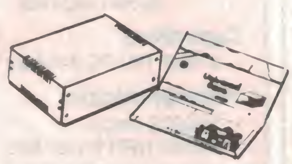
IEC CHASSIS MOUNT SOCKET WITH INTERFERENCE FILTER.

Protects instrumentation etc. from EMI (Electro magnetic interference) that can upset or destroy data transmission.
- 3 pin IEC male chassis socket.
- 250V-6 amp
- Approval No. CS32193N

P10255..$19.95

NEW

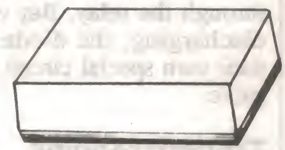


PREPAINTED ALUMINIUM CASES

·Dimensions:(W)80mm x (H)46mm x(D)65mm
H10141..$10.95
·Dimensions:(W)110mm x (H)50mm x (D)80mm
H10142..$13.95
·Dimensions:(W)140mm x (H)56mm x (D)110mm
H10143..$17.95
·Dimensions:(W)180mm x (H)56mm x (D)130mm
H10144..$23.95
·Dimensions:(W)230mm x (H)56mm x (D) 140mm
H10145..$32.95

These brilliant new universal kit boxes are supplied with screws, brackets and rubber feet. Each panel has been scored so it can be folded once only to form the cabinet walls. Each unit has anodised aluminum panels that are designed to be painted, the top and bottom also has air vents for cooling. They are available in five different sizes ideal for kits and projects and are flat packed for easy storage and display.

NEW



PLASTIC / ALUMINIUM FREESTANDING BOX

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Silver/ grey cabinet with aluminium front panel.
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·Rubber feet.
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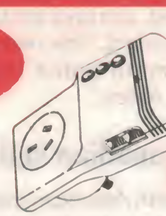


DON'T BE ZAPPED

FAX, PHONE, COMPUTER, MODEM, PROTECTOR.
240VAC/50HZ MAINS & PHONE LINE PROTECTOR

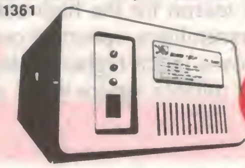
X10089..$59.95

This unique unit has been developed to offer the maximum possible external protection to the user equipment such as fax machines, computer modems & telephone answering machines. Both the phone lines and main power inputs are protected. The CPEP1 helps to reduce damage to equipment connected to the telephone network when subject to lightning strikes and mains power spikes and surges.

DESIGN
·Status Display:Red neon indicates "power on", green neon indicates "correct earthing contact"and amber indicates "faulty wiring " requiring attention.
·Power input/output:plug & socket arrangement allows inline installation.
·Line input/output:Dual US modular telephone sockets used for connecting the fax, telephone answering machine, modern etc.

PROTECTION:
·The unit uses a combination of M.O.V. and gas arrestor ciruitry to prevent damage to home and office equipment thus eleiminating down time and costly repairs.
·Approved by the Australian Dept of Minerals and Energy.
·Aproved #:n11361

NEW



EVERY HOME & BUSINESSMAN MUST HAVE ONE

UN-INTERRUPTABLE POWER SUPPLY
500 WATT UN-INTERRUPTABLE POWER SUPPLY

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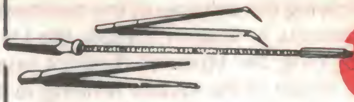
A Stand-by regulated power supply system.
·Designed for computer systems and related peripherals.
·Provides protection against blackout, brown outs, voltage fluctuations, power surges, spikes and line noises.
·Monitors 240 volt AC supplied to the system and removes any voltage transients and fluctuation prior to directing it through to the equipment. If AC power fluctuates beyond an acceptable level the UPS500 switches from normal to backup mode and continues to power the equipment with its own internal backup mode and continues to power the equipment with its own internal backup batteries until the AC power is returned to normal. At this point the UPS500 returns back to normal mode and proceeds to recharge its batteries.
·Audible alarm buzzer sound when unit transfers to backup power. this provides a warning to make backups or shutdown the computer system before any damage or data loss can occur. Buzzer can be manually turned off once the situation has been discovered.
·Approved by the Australian Dept of Minerals and Energy

SPECIFICATIONS:

Output Rating (Under Load):	500 watts
Voltage Unit Switches To Backup:	204 and 260 volts AC
Voltage Unit Switches To Normal:	212 and 252 volts AC
Input/Output Frequency:	50Hz or 60Hz
Typical Recharge Time:	10-12 Hours
Responce Time:	4mS (typical) /8ms (max)
Voltage Regulation:	+ / -5 %
Audible Alarm:	Buzzer and LED Indicators
Overload Protection:	3.15 amp
Internal DC Fuse:	40 amp
Dimensions:	144 x 242 x 436 mm
Weight:	20.5kgs
Safety:	According to IEC 380 AS3250

TOOLS & TECHNICAL



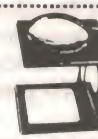
VERY VERY HANDY

COMPONMENT RETRIEVAL KIT

Supplied with two fully insulated tweezers and long flexible finger with a magnet on the end . Allows small components and to be picked up or manipulated in small, narrow hard-to-get-at places
T12084..$10.95

PLASTIC VICE WITH SUCTION BASE

Medium sized vice ideal for holding parts and components during soldering or glueing.
·Stong suction base adheres to any non porous surface.
·Lever secures or releases suction
·Plastic jaws with rubber pads
·Jaws open out to 50mm
·Size:Approx 110 x90 x80
T12459..$6.95



HANDSFREE MAGNIFYING GLASS

FOLDING MAGNIFYING GLASS
Free standing magnifing glass.
·Allows hands free operation
·Large 115mm (4.5") Lens
·Folds completely flat for storage
T10020..$13.95

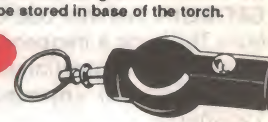
EXTREMELY POPULAR

ALUMINIUM TORCHES

Battery size:1xAA..........................Not Supplied
A15066.. $ 9.95
Battery size:2xAA..........................Not Supplied
A15068..$10.95
Battery size:3xAA..........................Not Supplied
A15067..$11.95

Machined "Aircraft Aluminium" flashlights.
·Lens case unscrews and doubles as a free standing torch base.
·Adjustable lens varies the beam from a spotlight to flood light.
·Rubber water resistant "O" rings.
·Replacement globe stored in base of the torch.

NEW RECHARGEABLE



RECHARGED KEY RING TORCH

Miniature handheld torch designed specifically for the car. It comes with a 'quick-click' removable keyring which allows removal of your car keys while recharging. The torch utilizes a nickel cadmium battery P which can be recharged serveral hundred times. this can be done at any time, even while driving as the torch body itself is shaped to fit directly into the cigarette lighter socket. ideal for use with cars, trucks, boats and other 12 volt negative earth vehicles. The unit is made of a sturdy black plastic, comes complete with a keyring and is push button operated.
A15070..$11.95

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NO BRAND DISKS

BOXES OF TEN DISKS LIFETIME WARRANTY

	10+	50+	100+	500+
5 1/4" DS/DD	$4.75	$4.55	$4.30	$4.40
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	1-9 boxes	10+
3 1/2"DD	$19.95	$18.95
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5 1/4"DD	$14.95	$12.95
5 1/4"HD	$23.95	$22.95

VERBATIM DATALIFE

	1-9 boxes	10+
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5 1/4"HD	$27.95	$26.95

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3 1/2"HD	$39.95	$37.95
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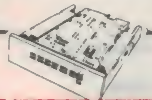
5 1/4"HD	$19.95	$18.95



HARD DRIVES

42 MEG HARD DISK FOR XT

28ms ACCESS WITH IDE/FDD CONTROLLER FAST STEPPER..........$549

42 MEG HARD DISK FOR AT

28 ms ACCESS WITH IDE/FDD CONTROLLER FAST STEPPER..........$329

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200 MEG HARD DISK FOR AT

12ms ACCESS WITH IDE/FDD CONTROLLER VOICE COIL.. 2 YEAR WARRANTY .$1,095

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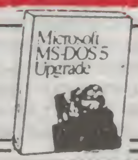
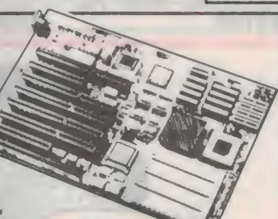
All Hard Disk capacities are formatted. IDE/FDD drives are already low level formatted so you only have to "F DISK" to high level format them. Please note you need DOS 4.01 to format these to their maximum capacity as drive "C" or otherwise you will have to partition as "C", "D","E:", etc. if you have an earlier version.

DOS 5.0 UPGRADE NOW AVAILABLE ONLY $120



RITRON 486-33 MAINBOARD



- Intel 80486 Microprocessor
- IBM, XT and AT
- Direct support for the Weitek 4167 coprocessor
- Built-in cache controller: Optional 32-KB, 64-KB, 128-KB or 256KB cache memory • 128Kcache fitted.
- Supports interleaved cache RAM for high speed CPU as well as 80486 burst mode . • Flexible DRAM 1-32MB
- Sophisticated DRAM controller
- AMI BIOS with built-in SETUP program
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- Synchronous AT bus clock with programmable clock
- Support fast A20 Gate & fast CPU reset to boost performance of software utilizing 80486 protected mode, such as OS/2, UNIX..etc.
- Eight expansion slots - Six 16 bit, Two 8-bit

X18131..$1,795

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The BIT Blitzer 1234E is an automatic, intelligent, 300/300, 1200/1200, 1200/75 and 2400/2400 bps full duplex, asynchronous and synchronous External modem, which meets the CCITT V.21/V.22/V.22bis/V.23 and Bell 103/212A standards. The BIT BLitzer 1234E provides all the 1200 and 2400 bps, Hayes AT+ features in a compact, low power, cost effective, reliable package, whilst giving you V.23 capability as well.

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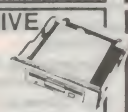
- Full duplex
- Auto dail
- Auto Answer
- Auto Disconnect
- Tone & pulse dialing
- 28 "S" Registers
- Call progress monitoring
- Loopback for remote dianostics
- Internal speaker with Command Protocal controlled volume settings

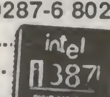
Only $420

3 1/2" DRIVE KIT. Y.E DATA 3.5" 1.44/720/360 DRIVE



- 5 1/4" Mounting bracket
- Power supply adapter
- Cable adapter
- Floppy disk controller card which controls 1.44/720/360 drives
- Complete Instructions to install a 3.5" in your existing computer. Enjoy the higher density & easy handling of 3.5" floppy diskettes! C11915..................$295

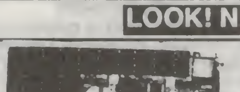
MATH CO-PROCESSOR SPECIALS



80287XL... replaces 80287-6 80287-8 80287-10..............$295
80387DX-33..$595
80387SX-16..$450
80387SX-20..$495

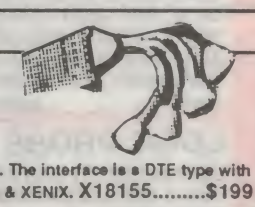
LOOK! NEW CARDS

"MegaRAM" Memory board



This new generation memory enhanced board offers 0 wait state high speed operation. It can take up to 6MBytes of 4 x 256K or 1 x 1M DRAM chip. Up to 7 cards can be used together (42MB EMS). It is 100% EMS 3.2 & 4.0 compatible, and best of all it can be used in an XT, AT or 386 because it is 8 bit, 16 bit configerable. So get yourself a Mega for the price of a Mini.
X18051..$299. 00

4 PORT SERIAL CARD



(Software Output cables included.)
The PE-514A has 4 serial ports for asynchronous communication. These ports can be used to connect your PC with a serial printer, MODEM, serial mouse or other serial devices which use an RS232C Interface. The interface is a DTE type with a male DB25P for 4 serial port output. It supports DOS & XENIX. X18155.........$199

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DIGITAL MULTI METER HC -4510
DISPLAY:4 1/2 DIGIT
BASIC ACCURACY: 0.5% DC V
DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
CONTINUITY TEST, DIODE TEST
DATA HOLD
Q13030...........RRP $149.95 NOW $129.95

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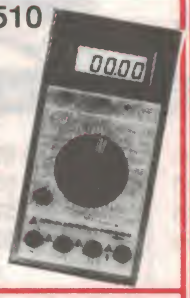

DIGITAL MULTI METER HC-5010EC
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BASIC ACCURACY: 0.5% DC
DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
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DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
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AUTO RANGE DMM WITH BAR GRAPH
Q13040.....................RRP $99.95 NOW $89.95

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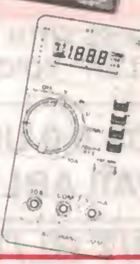

DIGITAL MULTI METER HC-3500T
DISPLAY:3/12 DIGIT
BASIC ACCURACY: 0.5% DC
DC VOLTAGE: 0-1000V
DC CURRENT: 0-20A
AC VOLTAGE0-750V
AC CURRENT 0-20A
RESISTANCE: 0-20M OHMS
TEMPERATURE:-20C -1200C
CONTINUITY TEST, DIODE TEST
TEMPERATURE CAPACITANCE
FREQUENCY, hfe TEST, DATA HOLD.
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DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
DC AC RMS:-45dB -+50dB
TEMPERATURE: -20C-1200C
AC FREQ SPREAD: 50Hz-2KHz
CONTINUITY TEST, DIODE TEST
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LOGIC PROBE (LP-2800)
USEFUL FOR TTL AND CMOS.
HIGH & LOW INDICATORS
PULSE MEMORY.
FOR THE HOBBIEST OR SERIOUS TECHNIICIAN
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ORDER NOW FOR CHRISTMAS!

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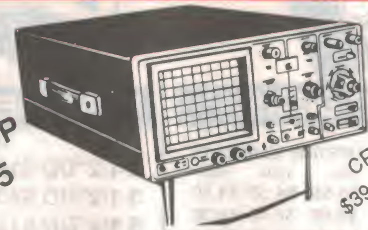
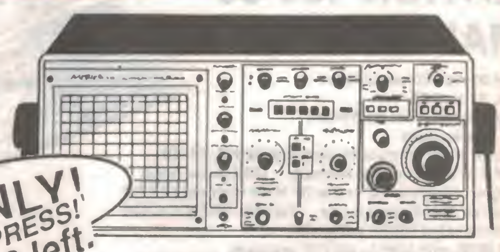


CRO Probe to suit $39.50 each - Cat. Q12201.

20 MHz DUAL TRACE OSCILLOSCOPE
CTR DISPLAY: • 150 mm rectangular
VERTIACAL DEFLECTION:
• Deflection Factor: 5mV to 20V / Div on 12 ranges in 1-2-5 step with fine control
• Bandwidth DC: DC to 20 MHz (-3dB) AC: 10Hz to 20 MHz (-3dB)
• Operating modes CH-A, CH-B, DUAL and ADD (ALT/CHOP L202 only)
• Chop Frequency: 200 KHz Approx.
• Channel separation: Better than 60dB at 1KHz
TIME BASE
• Type: Automatic & normal triggered in automatic mode, sweep is obtained without input signal
• Sweep Time: 0.2m Sec to 0.5 Sec/ Div on ranges in 1-2-5 step with fine control and X-Y.
• Magnifier: X5 at all times.
TRIGGERING
• Sensitivity Int: 1 Div or more Ext: 1Vp-p or more.
• Source: INT, CH-B, LINE or EXT
• Triggering Level: Positive and Negetive, continuously variable level; Pull for Auto.
• Sync: AC, HF Rej, TV (each + or-) at TV Sync. TV-H (line) and (frame) sync are switched automatically by SWEEP TIME/Div switch.
HORIZONTAL DEFLECTION
• Deflection factor: 5mV to 20V/ Div on 12 ranges in 1-2-5 step with fine control
• Frequency response: DC to MHz (-3dB)
• Max Input Voltage: 300V DC + AC Peak of 600V p-p
• X-Y operation: X-Y mode is selected by SWEEP TIME/ Div switch.
• Intensity Modulation Z Axis: TTL Level (3Vp-p~50V) + bright, - dark
OTHER SPECS: • Weight: 7Kg Approx • Dimensions: 162 (H) x 294(W) x 352(D)mm.
Q12105.........................RRP $750 NOW $695



4 ONLY!
STOP PRESS!
Only 3 left.

100 MHz 3 CHANNEL 8 TRACE MODEL 5510

This instrument meets the customers needs in quality of performance, efficiency, function, design, and cost! Being rugged, highly reliable and a multi-purpose 3 - channel, 8 trace oscilloscope with a 6 inch domed mesh type 14kV post deflection acceleration cathode-ray tube and with a fine red internal graticule.
FEATURES:
• Compactness, lightweight, ruggedness and simple design.
• The diecast frame provides compactness lightweight and ruggedness .
• Easy Operation
Light torque lever switches and pushbutton switches are used.
• High Brightness CTR, high acceleration voltage and high beam efficiency of the 150mm rectangular CTR ensures a bright high speedsweep observation
• Multi mode display system
CH1, CH2, CH3, Add any combination or all the channels may be viewed simultaniously. Maximum 8 trace displaying is possible with the ALT sweep function.
• High sensitivity and wide frequency bandwidth.
The maximum vertical sensitivity is 1mV/DIV (when x 5 MAG)at 20 MHz or greater 3dB and mV/DIV at 100 MHz or greater -3dB.
• High input impendance
The input impendance of CH1, CH2, CH3, is 1MΩ†2%, 25pF †3pF
Q12109.........RRP $2995.00 NOW $1,995

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	1-9	10-99	100+
P10514	$2.50	$2.25	$1.50

BNC PANEL SOCKET

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BNC SOLDERLESS TWIST ON PLUG

	1-9	10-99	100+
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	1-9	10-99	100+
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	1-9	10-99	100+
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	1-9	10-99	100+
P10960	$4.50	$3.50	$2.50

COMPUTER CABLES

• Six conductor shielded computer interface cable.

W12670 • CIC6 6 con.

1-9M	10M+	100M+
$1.30M	$1.10M	$1.00M

W12672 • CIC9 9 con.

1-9 M	10M+	100M+
$1.60M	$1.50M	$1.20M

W12674 • CIC12 12 con.

1-9M	10M+	100M+
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W12676 • CIC16 16 con.

1-9M	10M+	100M+
$3.50M	$3.20M	$2.50M

W12678 • CIC25 25 con.

1-9M	10M+	100M+
$3.90M	$3.40M	$3.00M

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QUALITY 3mm LEDS

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Z10145(O)..	$0.20	$0.18	$0.15

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Z10151(G).	$0.25	$0.20	$0.18
Z10152(Y)..	$0.25	$0.20	$0.18

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RED 5mm	1-9	10+
Z10159	$1.10	$1.00

RECTANGULAR LEDS

	1-9	10+	100+
RED	20¢	15¢	12¢
GREEN	20¢	15¢	12¢
YELLOW	20¢	15¢	12¢
ORANGE	20¢	15¢	12¢

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LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile IC sockets! PCB mounting solder tail. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

		1-9	10+	100+
P10550	8 pin	15¢	12¢	10¢
P10560	14pin	20¢	18¢	15¢
P10565	16pin	20¢	18¢	16¢
P10567	18pin	30¢	25¢	22¢
P10568	20pin	35¢	30¢	25¢
P10569	22pin	35¢	30¢	26¢
P10570	24pin	35¢	30¢	26¢
P10572	28pin	45¢	35¢	30¢
P10575	40pin	45¢	40¢	35¢

WIRE WRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin plated phosphor bronze.

P10579	8pin	$1.50	$1.40
P10580	14pin	$1.85	$1.70
P10585	16pin	$1.95	$1.80
P10587	18pin	$1.95	$1.80
P10590	20pin	$2.95	$2.75
P10592	22pin	$2.95	$2.70
P10594	24pin	$3.95	$3.50
P10596	28pin	$3.95	$3.50
P10598	40pin	$4.95	$4.50

ELECTRET MIC INSERTS

With pins for easy board insertion. C10170

1-9	10-99	100+
$1.20	$1.00	$0.90

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Designed to transmit at 40kHz (L 19990) & recieve at 40kHz (L19991) withup to 20V I/P on the transmitter. These units can't be heard so are ideal for TV remote controls, water level dectectors, burglar alarms, motion dectectors & information carriers as they can be either pulsed or used in a continuous wave mode.

Transmitter	1-9	10+
L19990.......	$2.95	$1.95
Receiver		
L19991.......	$2.95	$1.95

IDC PLUGS & SOCKETS

WOW ! FROM $1.00

D TYPE IDC PLUGS

	1-9	10+	100+
• DE9P 9pin plug			
P12166	$1.50	$1.20	$1.00
• DA15P 15pin plug			
P12168	$1.50	$1.20	$1.00
• DB25P 25 pin plug			
P12170	$4.50	$3.95	$3.50

D TYPE IDC SOCKETS

	1-9	10+	100+
• DE9S 9 pin socket			
P12167	$1.50	$1.20	$1.00
• DA15S 15 pin socket			
P12169	$1.50	$1.20	$1.00
• DB25S 15 pin socket			
P12171	$4.50	$3.95	$3.50

IDC CENTRONICS 36 WAY PLUG & SOCKET

	1-9	10+	100+
• Plug P12200	$3.95	$3.00	$2.95
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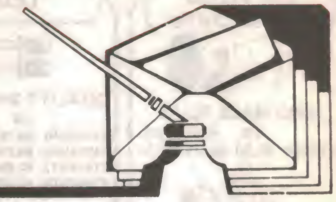


Conducted by Peter Phillips

DACs and current flow

There's more than the usual number of circuits this month, as well as some arguments about the speed of current flow. And to help you keep your hand in over the Christmas holidays, the usual What?? question.

Digital to analog converters (DACs) are virtually everywhere these days: in computers, CD players and other things where digital circuits need to 'talk' to an analog world. They are mostly in IC form, but this month we feature the DAC not as an IC but as a circuit using discrete components. And while I had the computer drawing program fired up, I decided also to present another very useful digital circuit sent in by a reader. But first the discussion on DACs...

Motor control

In answer to a question posed by a young reader (J.B. of Glen Waverley Vic) about how to control a motor using a Microbee computer, I gave a simple transistor interface circuit to allow the motor to be reversed and switched on or off by using the computer data lines. However several readers have written suggesting that perhaps J.B. wanted to also control the speed of the motor, as the original letter asked whether a D to A converter was needed.

So if you're reading J.B., here's some additional ideas to help you with your experiments:

May I suggest that you perhaps missed a point about Microbee control of a motor, and that the query about a D to A converter could have been aimed at getting variable speed control.

For this purpose it is far better to obtain such control by programming the computer than by using D to A circuitry. Not only is it cheaper, but it helps to overcome the 'stiction' problem that DC motors often experience when driven at low voltage in an attempt to achieve low speed operation. This is caused by irregularities in the brush-to-commutator resistance as it revolves. Unimportant at full speed where inertia carries the rotor over the poor spots, it can give erratic performance if driven by a low, constant voltage.

This can be overcome by driving the motor from its rated voltage for some of the time and from zero volts for the rest, provided the intervals of successive full-zero-full-zero... are short enough for the motor inertia to smooth out the speed fluctuations. Vary the ratio of full-zero interval lengths to vary the speed. The process is known as pulse width modulation (PWM) and a range of integrated circuits to implement PWM are available. Some are designed primarily for voltage converter/regulator service, but could easily be adapted to this sort of task.

On the other hand, it is not difficult to program a computer to provide a PWM signal at D0 in the circuit of Fig.3 page 109, September 1991. I would be tempted to use a basic step of 1 millisecond for the signal, counting off groups of 10 (of which 0 to 10 would be high to give 0-100% range of speed over nine intermediate steps) for the PWM cycle. There is no added component cost for speed control. (G.W., Florey ACT).

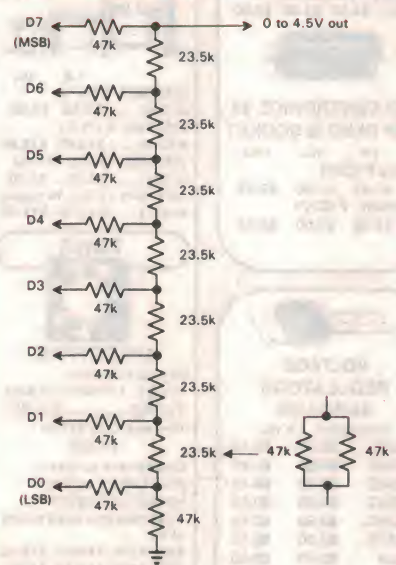


Fig.1

Thanks G.W., for making this point. PWM is obviously simple to implement with a computer, as the software does all the work. In fact, when you think about it, PWM is used extensively in control situations, such as in a switch mode power supply.

About the only considerations I can think of are the need for the transistor driving the load to be protected against the back EMF of the motor and also that it be able to switch quickly.

The next letter approaches the problem rather differently...

In a question asked in September concerning controlling Lego motors from a Microbee computer, you replied that a DAC was probably not necessary and that control should be possible from a digital source.

But what if the equipment you need to control cannot 'talk' digital? I thought readers, especially those new to electronics may be interested in the R-2R DAC circuit.

This circuit is very simple and requires two resistor values only, one called R and another 2R, which is twice the value of R. If two resistors equal to the value of 2R are connected in parallel, the R value resistors can be obtained. Using this, the R-2R circuit can be built using resistors of only a single value.

For computer control, the R-2R network can be connected to an 8-bit output port, such as a parallel printer port. This arrangement will give up to 256 different voltage levels that could be used to control the speed of a motor through a suitable interface. I would advise con-

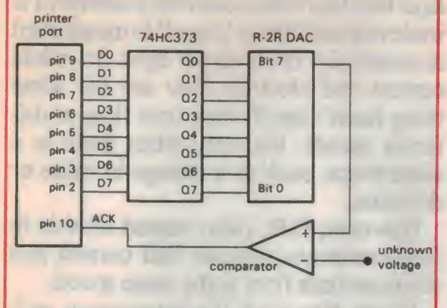


Fig.2

necting the R-2R circuit through a buffer IC such as the 74HC373.

The controlling software is very simple, in which the required 8-bit code for a particular speed is sent to the printer port. For example, writing zero to the port would give 0V out, 128 (hex 80) would present about 2.25V and 255 (hex FF) would give the full output of about 4.5V.

This circuit can also be used as the basis for a simple analog to digital converter (ADC) by connecting the DAC output and the unknown voltage to a comparator. The output of the comparator is then connected to an input pin such as an interrupt or the ACKnowldge pin of a printer port. The unknown voltage must be within the output range of the DAC of course.

The software then writes increasing or decreasing values to the output port until the comparator output changes. One way to do this is to write values starting at 255 (hex FF) and reducing by one towards zero. After each write to the port, the software needs to check if the output of the comparator has changed state. When this happens, the unknown voltage can be calculated by the software using the equation: (numerical value sent to port/255) multiplied by the maximum DAC output voltage. If conversion time is critical, you could use the binary search technique to find the point of equality and to hold calculated values in a look-up table, perhaps in a ROM. This value could then be displayed on the screen or sent to a printer.

I hope this circuit will prove as useful to readers as it has to me. (P.B., Artarmon NSW).

Yes indeed. The R-2R circuit is the basis of the DAC0800 chip and its derivatives, but we rarely see it in its raw form. The circuit of the network is shown in Fig.1 and all you need are lots of 47k resistors (or any convenient value, providing they're all the same). The 'computer controlled' ADC circuit is shown in Fig.2.

Another way of constructing a DAC is to use the 'weighted resistor' network shown in Fig.3. In this circuit, eight resistors are connected to an op-amp summer. The resistors have values related to the binary 'weighting' of the input: 1, 2, 4, 8 and so on up to 128 for an 8-bit DAC. The value of the feedback resistor Rf depends on the required maximum output voltage. The problem with this circuit is getting resistor values to suit, although at first glance it appears simpler than the R-2R circuit. The operation of the circuit is quite basic. Input D7 will produce the highest output from the op amp as the input resistor has the lowest value. The output for each input is simply the input voltage multiplied by (Rf/input resistor). The higher the value of the input resistor, the lower the output voltage. For a typical digital circuit the input voltage is usually about 5V. If more than one input is 'high', the output will be the sum of each input.

Thanks for your letter P.B., as it has provided an ideal opportunity to talk about something that is now usually buried in the mystery of an IC.

And while we're on the topic of digital circuits, here's a rather useful circuit...

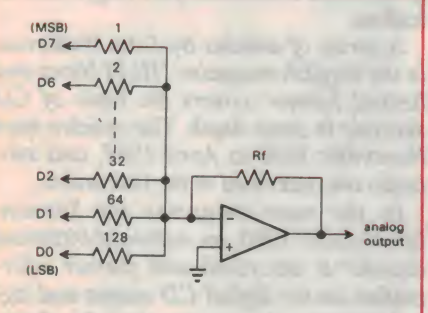


Fig.3

Toggle action

It is often necessary to control a logic-driven device from a front panel switch in a 'this-or that' mode. At first sight, push-on/push-off (alternating action) switches are the way to go. This is fine, provided the comparatively high cost can be ignored. Contact bounce is also often a problem, particularly after a few months of use. Of course, this can be guarded against in the design of the circuit, but consider an alternative:

Two logic inverters, two resistors and a capacitor will convert a simple non-locking pushbutton switch to toggle action. Each push reverses the state of the logic signals — plural, because the signals are available as a complementary pair from the two outputs of the circuit. In many cases, the logic inverters may be 'free' as spares in an IC where only some of the inverters are used by the circuit.

A CMOS circuit is shown in Fig.4, although the component values can be varied widely. The inverters are connected as a ring, so that whatever the state of the second output, it is fed back to its input, after inversion by the first inverter. This perpetuates that state, giving a stable flipflop.

Meanwhile, capacitor C1 is charged via resistor R2 to the complement of the output of the second inverter. When the button is pressed, the voltage at the first input is momentarily complemented (with R1 limiting the current). Its output state reverses, changing the state of the second. This feeds back to the first input (slightly attenuated by the dividing action of R1 and R2) allowing the new state to be held as long as the button is pushed, then retained when the button is released. Then the capacitor charges to the changed output of the first inverter, ready to return the complement (pardon the pun!).

A question of timing may arise. What happens if the button is pressed in quick succession? About 330ms is required for the capacitor to adjust its voltage to the new state. Less than that and the results

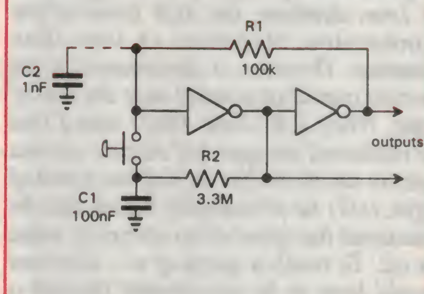


Fig.4

become unpredictable, except that a very short break is not going to allow the capacitor voltage to change enough to have any effect at the next push.

And what state does the circuit assume at start up? This is unpredictable, depending on circuit characteristics, which may be a problem in some cases. However, by adding capacitor C2, the output can be predicted at start up, as it will hold the input of the first inverter low for around 100us, so that the first and second outputs initialise at high and low respectively.

How can we tell the current state? Often the circuit being controlled will have some form of indicator, but this could also be provided by one of the inverter outputs. A LED driven in active low mode could be added using a LED connected to a +5V rail, in series with a 300

ohm resistor. (Gordon Wormald, Florey ACT).

Thanks yet again, Gordon. This circuit is one of those 'really useful' ones that you can never think of when you want it. I'm filing it with my collection of useful ideas — perhaps other readers may like to do something similar (after you've read the rest of the column of course)!

Speed of electrons

In the June and September editions, I included letters that gave differing opinions on the speed of electron flow. Here's a couple more:

The speed at which electrons travel in an electric current in a wire or electrolyte is NOT the same as the speed at which a signal (pulse or wave) is transmitted in the same conductor. The typical speed of conduction electrons in copper wire is surprisingly slow, and even the speed quoted by D.L. in September of about one centimetre per second is in fact somewhat high.

(Incidentally, you should throw away your calculator: 1cm/sec is 36 metres per hour, not 36km/hour as you stated).

If a current of 1A flows in a copper wire of 1mm diameter, the drift speed of the conduction electrons is less than 1mm/sec. However, a disturbance in the current travels at a speed near the that of light. When B.B (June 1991) stated that he measured the speed of electric current (sic) in an electrolyte as half the speed of light, (c/2) he presumably meant that he measured the speed of an electrical pulse as c/2. To reach a speed of c/2, electrons would have to be accelerated through a voltage of 80kV without losing energy in collisions. This is hardly likely in most electrical applications.

Your analogy with the slow movement of a solid bar illustrates the difference between disturbance speed and bulk speed, but the analogy with sound travelling in air is probably more instructive. Sound (disturbances in the movement of air molecules) travels at a speed of 330 metres/sec, but the bulk air that carries it certainly doesn't travel at this speed.

Similarly, in an electrical conductor, the charge carriers have a very small, or even zero, systematic drift speed, but the disturbance (signal) will be passed down the line from charge to charge at very high speed. (J.D., Warncoort Vic).

Before I throw in a few lucid (if potentially inaccurate) comments, see what you think about the next letter:

Just a quick note on the speed of electrons in conductors.

This is an area (that should be) covered in most undergraduate electronics degrees, as signal propagation is a problem in many areas, especially in high speed digital design and anything analogue above UHF.

Looking at propagation in the real world, the measurable velocity in a PCB track is around 20cm per nanosecond, or about 2/3 the speed of light, (a lot more than 36kph). Whether the electrons we originally shoved in are those that pop out the other end is immaterial, as it's hard to tell one electron from another.

Being less flippant, in valves and TV tubes, there are a small number of free electrons available and they all get accelerated towards and hit the screen (like the movement of water molecules from a garden hose). In 'normal' electronics, while all the electrons are accelerated and move to some degree, we are interested in the movement of a signal through an electron rich environment, like waves in an ocean, rather than the movement of individual electrons.

At normal current densities, the nett number of electrons passing a point is only a very small percentage of the free electrons moving about. To put some figures to the analogy, consider a current of 10A in a 1mm^2 copper wire. Let's look at the number of electrons available for current flow and the number required to carry the current. Using basic mathematics, there are around 2^{23} electrons per cubic metre. (Maths supplied: Ed)

The total 'active' electron density can also be calculated and works out at about 2^{17} electrons per cubic metre. (Maths also supplied: Ed)

So on average (if my figures are anywhere near correct), only one in every million free electrons moves. To put it another way, if you moved all the electrons, the current would be 10 million amps! (I think that's referred to as ionisation).

While this is a bit oversimplified, I hope it's stirred the mud a bit. Perhaps we need a physicist to help us out on the differing modes of current transfer. (C.D., West Perth WA).

Phew! Recapping the arguments, D.L., (September) suggested that electrons travel at a high orbiting speed and that current creeps along at 36 metres an hour (using the corrected figure). This argument is supported by J.D., who suggests that the speed of the current is even lower. Using J.D's speed, an electron entering a metre length of wire will emerge from the other end 1000 seconds or 16.67 minutes later (speed of 1mm/sec). However, a pulse (or disturbance) travels at almost light speed.

If my interpretation is correct, C.D. says that individual electron movement is irrelevant and that a 'signal' is transmitted at around 2/3 the speed of light. So, while current and electron flow are the same thing (aren't they?) they both flow at different speeds, but only when there is a disturbance, such as a change in value or direction.

However, B.B. (who started all this in June) seems to indicate that current and electrons both flow at the same speed.

Maybe I've got B.B's letter wrong, as it seems reasonable to me that a change will be almost instantaneous, and that the carriers (electrons) simply pass the change along. And ions are merely a transfer system for the carriers that pass the change.

Throwing in a total red herring: if current and electrons travel at different speeds, can they also flow in different directions?

Moving to less esoteric territory, here's some more about CD subcode.

CD subcode

The next letter answers a query posed by a reader in September who asked about CD subcode. Oh! It's from the same reader...

Since my last letter I've discovered the answers to most of my questions, although I still think there is a sinister conspiracy of silence.

It appears that Philips and Sony have developed a standard for 'domestic digital audio' that is described in three manuals. These are available at a cost of \$10,000 each. That's \$30,000 for the set. Thus we have the ridiculous situation of Philips discouraging people from using their own 'standard'.

Fortunately all is not lost. The Philips IC Data Handbook gives most of the answers and the Philips SAA7274 IC, a receiver for this Philips/Sony format, is a good starting point. But we still need an easily understood article that unravels the whole business. How about it, guys? (G.L., Ringwood, Vic).

A good idea G.L., and one we may well follow up. In the meantime, the next letter gives some references you might like to look at.

A series of articles by John Watkinson in the English magazine 'Hi Fi News and Record Review' covers the topic of CD subcode in some depth. The articles span November 1986 to April 1987, and subcodes are described in the last article.

In the same magazine for September/October 1990, an outboard bitstream decoder is described with further information on the digital CD output and signal recovery. It appears that the digital output does not contain subcode data, but does carry data stream/word select

What??

Rectifier circuits are always a good source for a question, as regular readers might recall.

The question this month concerns the circuit shown in Fig.5. All you have to do is sketch the waveform across resistor R3. Assume a 50Hz sinewave AC supply to the transformer.

Happy Christmas!

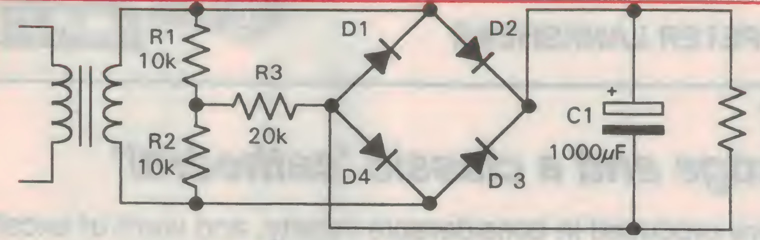


Fig.5

(L/R)/clock data/mute/de-emphasis flag data. From this an ASIC recovers appropriate information.

A series of articles by Malcolm Hawksford in the same magazine describes DAC and ADC circuits in detail (Feb, April, June to August 1990). The later articles cover the newer DAC 7 chips. Hope this information is useful. (J.W., Ingleburn NSW).

My thanks to both writers, as CD subcode data is possibly an area that an increasing number of readers will become interested in as CD players become cheaper and more prevalent. And on the topic of emerging technologies, the next letter suggests we develop a project to test computer monitors.

Monitor tester

I believe there is a need for a pattern generator capable of testing EGA and VGA computer monitors. Could EA publish such a design, or a converter of some sort to adapt an existing TV pattern generator for testing these monitors? (B.R., Calwell ACT).

While this seems a good idea, and certainly a feasible one, there are a number of considerations that make it more complicated than it first appears. For starters, the scan frequencies and sync polarities differ between these standards. Also the type of signal required is different as one is direct digital and the other a mix of analog and digital. Also, if we develop such a project, you can bet IBM or someone will come up with yet another standard. As well, there are other popular standards including Hercules, CGA and SVGA.

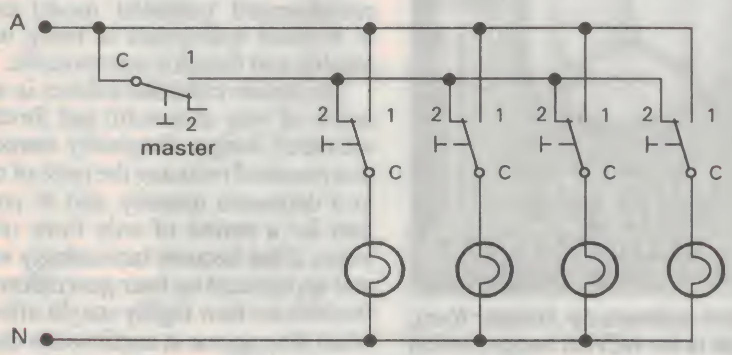
However, all is not lost. A computer program called CARD was described on page 136 in September EA and is designed specifically to test computer monitors. The program costs a mere $40, although naturally you'll need a computer fitted with the right kind of video display card to run it. Still, given the plummeting cost of computers, this may well be the most cost effective and flexible means of testing computer monitors. ■

NOTES & ERRATA

CRO ADAPTER FOR MONITORS (March, May, June 1991): Some brands of 6116 static RAMs do not function correctly in this project. One that definitely works is the NEC type D446C-3. ■

Answer to November's What??

The circuit required for the lighting arrangement described in November is shown in Fig.6.



NEW KITS FOR EA PROJECTS

Jaycar has advised that it has released a kit for the following *EA* project:

KARAOKE ADAPTOR (November 1991): The Jaycar kit is for the complete adaptor, as described, with box, all specified parts and a Scotchcal front panel. With a Jaycar catalog number of KA1738, the kit is priced at $27.95.

NOTE: This information is published in good faith, from information supplied by the firm or firms concerned. Electronics Australia cannot accept responsibility for errors or omissions.

PC-based CIRCUIT SIMULATION

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PC controlled radio

(Continued from page 99)

we're out of space. MEMORY is a nice gadget to read the IC735's twelve memories into a disk file, or to load them from another disk file.

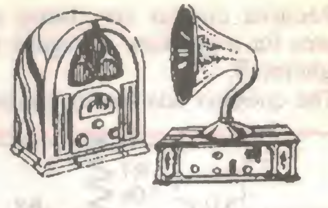
All is not lost however. As mentioned in the first of these articles, heaps of software has come out of this and my other computer control projects. I'm going to gather it all up — this article's, the first article's, and stuff from earlier experiments, onto a 5-1/4" MS-DOS disk which you can have for $25, posted anywhere in Australia or New Zealand. Write to the author at the address below.

The disk contains programs for Icom, AOR, and Yaesu, written in Basic, C, and Assembler, for the IBM-PC, Microbee, and CP/M. There is also a table containing the complete Icom command set, showing how each command is formatted. You will be welcome to copy any routines or even whole programs for your own experiments in computer control.

Kits for the interface are available from High-Tech Tasmania (of Listening Post II fame), 39 Pillinger Drive, Fern Tree, Tasmania 7054. The cost is $35.00 postpaid, anywhere in Australia or New Zealand. Money orders or cheques only please; we're still a bit too small to support credit card facilities. Please be sure to specify an 'Icom RS-232 interface', because there will soon be a version for Yaesu radios as well. ■

Vintage Radio

by PETER LANKSHEAR



Societies, the NZVRS badge and a classic 'cathedral'

Although Australian made receivers were produced in considerable variety, and were of excellent quality, increasing numbers of Australian vintage radio enthusiasts are broadening their horizons by importing receivers, and by membership of the New Zealand Vintage Radio Society.

Late in 1930, the Australian Government introduced tariff restrictions which severely limited the importation of radio receivers. This move fostered a strong and valuable indigenous Australian radio industry, but has limited the range available to today's vintage radio enthusiast.

New Zealand did not have restrictions for a further six years, permitting until 1936 a steady flow of imported receivers, particularly from America. This period is regarded as the golden age of radio, and America, by reason of its dominance in research, styling and quantity of manufacturing, led the field.

Fortunately, during the 1970's, a general awareness of the importance of preserving this technical heritage began to grow, encouraging the salvaging of valve receivers. Consequently, a relatively high proportion of these classics has survived, and New Zealand collectors have had a wide range of receivers to chose from, often at little cost.

Increasing numbers of Australians are realising the significance of vintage radio, and many have discovered that New Zealand is something of an Aladdin's Cave of exotic radios. New Zealand collectors are now having to compete with Australian bidders at auctions, and in the process have discovered the real value of some of the classic receivers.

Vintage societies

Before 1979, individual enthusiasts operated in relative isolation, but inevitably they realised the benefits of forming group organisations. Both Australia and New Zealand are now fortunate in having thriving and well managed societies, dedicated to fostering the various aspects of the hobby. A significant number of members on each side of the Tasman belong to both organisations.

For the past decade, the Historic Radio Association of Australia has been active in promoting the cause of vintage radio. An important service is the publishing of the quarterly magazine, the *H.R.S.A. Newsletter*, edited by Ray Kelly. Each issue contains articles covering various aspects of vintage radio, and most importantly buy, sell or swap columns. There are several active local branches where members can assist each other, exchange information and ideas, and trade equipment.

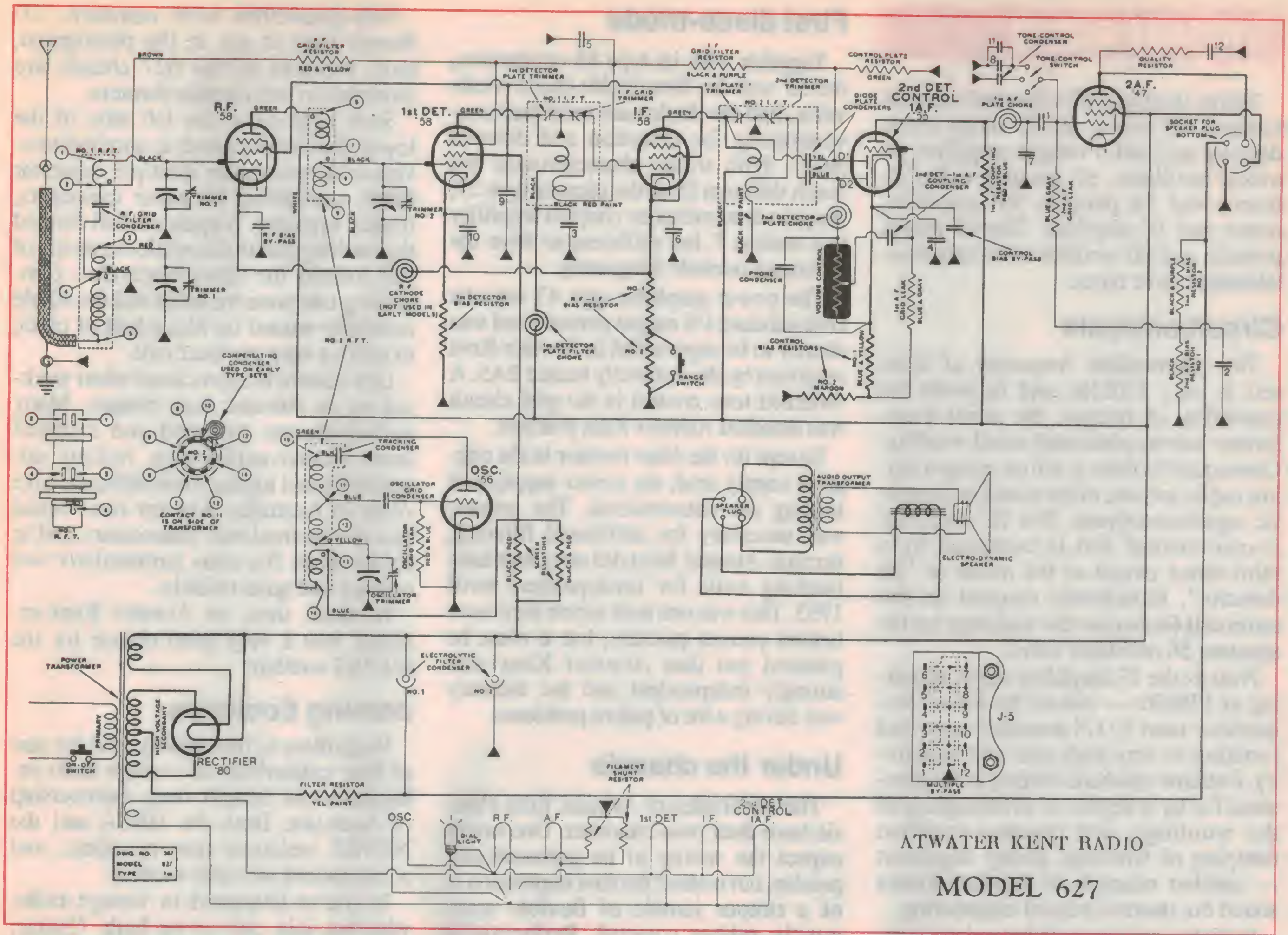
An organisation with similar objectives, The New Zealand Vintage Radio Society was established in 1979 and now has several hundred members. The parent group meets twice monthly in Auckland, and a very active branch is based in Wellington. The quarterly *NZVRS Bulletin* is the official publication, with international author John Stokes as its editor. Like its Australian counterpart the *Bulletin* includes articles and illustrations covering all aspects of vintage radio, and features both 'Wanted' and 'For Sale' columns.

Choice of symbol

The two threads in this article come together in the choice of the symbol for the NZVRS membership badge. Clearly the motif had to be instantly identifiable with a radio society and two subjects were possibilities. An 'R' type valve was considered, but this could be mistaken as representing a valve collectors' society. A radio was therefore chosen, and a round-topped 'cathedral' model seemed to be most appropriate as being unmistakably and instantly recognisable.

The classic cathedral cabinet is an example of very successful and functional industrial design. Originally introduced as a means of reducing the price of radios in a depressed industry, and in production for a period of only three or four years, it has become increasingly valued and appreciated by later generations. Cathedrals are now highly sought after, and when they appear at auctions are the centre of attention not only by collectors, but

Left: one of a dozen or more different 'cathedral' style cabinets by Atwater Kent, this one housed both the 558 and 627 models. At right is the NZVRS badge, which reproduces the cabinet to symbolise clearly the Society's interests.



Like all Atwater Kent receivers, the 627 was well designed. Thorough bypassing and the use of RF chokes for decoupling resulted in a very stable receiver.

often by antique dealers and also the public, who regard ownership as prestigious. Significantly, in recent years, several replica cathedral models fitted with modern receivers have found a ready market.

How the term 'cathedral' originated is not certain, but a likely explanation is that it resulted from some of these cabinets having fascias reminiscent of the pointed or Gothic arch associated with medieval cathedrals.

The model chosen for the NZVRS badge is the quintessential cathedral model and a classic from one of the leading American makers, Atwater Kent. Dating from late 1932 and used for two models, the 627 and 558, this attractive cabinet has the classic arched fascia, with the Gothic motif echoed in the speaker fret.

Atwater Kent quality

Fortunately Atwater Kent receivers were actively promoted and imported into New Zealand for most of the firm's existence, and their popularity and quality have ensured that a significant number have survived.

Arthur Atwater Kent set very high standards. He insisted on the highest quality finish for his Bakelite mouldings and metal pressings, and he had a flair for making attractive products. His earliest receivers, the much prized 'breadboards', were not intended to be hidden in cabinets at all, but stood alone as well finished instruments. Later he did accept the need for enclosures, but chassis without cabinets remained readily available.

When he did use cabinets, he made sure that they had style. Some of his consoles were ornate, but even the humble mantle sets reflected quality and attention to detail. Atwater Kent receivers are easily recognisable — a factor which, together with their fine performance and quality of workmanship, makes them classics.

As a pioneer and independent, Atwater Kent who was at one time America's largest manufacturer of radios, had his own unique and distinctive methods. He used his own resistor colour code and at one stage his cabinet nameplates were gold plated.

Receiver details

Inside the cabinets the chassis and speakers continued the tradition of good looking equipment. The usual cadmium or zinc plating on lightweight metal was not good enough. Atwater Kent chassis were *solid*, and nickel plated. Transformer covers and speakers were enamelled in a particularly rich shade of dark chocolate, matching the Bakelite mouldings. Setting them off were gold shields and a gold speaker magnet. The earlier aluminium IF transformer shields were unique: each had a neatly fitting lid concealing the trimmer capacitors, effectively guarding against unqualified 'tweaking'.

The 558 and 627 superheterodynes were typical of Atwater Kent circuit design: sound and conservative. Essentially the same as the 627, the 558 had an additional inter-station noise limiter or squelch valve.

VINTAGE RADIO

Valves used included the then recently released 50 series: the 55 diode triode detector and audio voltage amplifier, 56 triode oscillator, 57 pentode noise silencer and 58 pentode RF amplifier, mixer and IF amplifier. The 47 output pentode and 80 rectifier were longer established valve types.

Circuit analysis

The intermediate frequency of these sets is only 130kHz, and to avoid the possibility of images, the aerial transformer has an additional tuned winding. Consequently there is a four-ganged tuning capacitor, not often found in domestic superheterodynes. The RF amplifier is conventional and is connected by a third tuned circuit to the mixer or '1st detector'. Inductively coupled on the same coil former are the windings for the separate 56 oscillator valve.

Next is the IF amplifier stage, operating at 130kHz — one of the lowest frequencies used by US manufacturers, and resulting in very high gain and selectivity. Extreme sideband cutting is compensated for by a degree of overcoupling of the windings, and requires resistive damping of windings during alignment — another example of Atwater Kent's sound but unconventional engineering.

In high signal strength but noisy reception locations, effective automatic gain control systems can result in unpleasantly high noise levels between stations. To cope with this, the model 558 has an adjustable muting system using a type 57 valve, but the 627 relies on optional desensitising of the RF and IF amplifiers by means of an additional cathode bias resistor, controlled by a 'range' toggle switch on the left side of the cabinet.

First diode-triode

Together with its type 85 companion, the 55 was the first double-diode-triode valve, and the diodes are used here conventionally for detection and delayed AGC. With triode characteristics not much different from the pioneer type 27, the gain as a resistance coupled amplifier is a modest 5, but sufficient to drive the 47 output pentode adequately.

The power amplifier type 47 was the first standard US output pentode and was shortly to be superseded in Atwater Kent receivers by the indirectly heated 2A5. A switched tone control in the grid circuit was standard Atwater Kent practice.

Except for the filter resistor in the negative supply lead, the power supply and biasing are conventional. The resistor was necessary for additional filtering, because Atwater Kent did not adopt hum bucking coils for loudspeakers until 1933. This was one area where they were behind current practice, but it must be pointed out that Atwater Kent was strongly independent and the industry was having a lot of patent problems.

Under the chassis

The undersides of Atwater Kent chassis have their own character. One might expect the wiring to be geometrically precise, but instead the first impression is of a riotous jumble of flexible wire, mostly rubber covered. Perfectionist though he may have been, Atwater Kent was hard nosed enough to realise that fancy wiring was very expensive in time and did nothing at all for performance. Instead, although critical leads were short and carefully planned, the wiring operation was a typical mass production assembly line process, based on speed and simplicity. Some leads were actually wire wound resistors.

Sub-assemblies were common. Although hard to see in the photograph, most resistors in the 627 chassis are mounted on two circular formers.

Seen edge-on at the left side of the lower side of the chassis is another innovation: a rectangular multiple capacitor block containing 12 paper capacitors, mostly bypasses. A common foil formed the earthing electrode, while segments of foil formed the other electrodes. Connecting tabs were included and the whole assembly wound up like a bolt of cloth, to make a very compact unit.

One feature is appreciated when working on an Atwater Kent chassis. Many manufacturers wrapped and crimped leads around solder tags, making unsoldering and replacement difficult. Like AWA in Australia, Atwater Kent found that this method was unnecessary and to solder leads flat onto terminations was quicker and quite reliable.

In short, then, an Atwater Kent receiver was a very good choice for the NZVRS emblem.

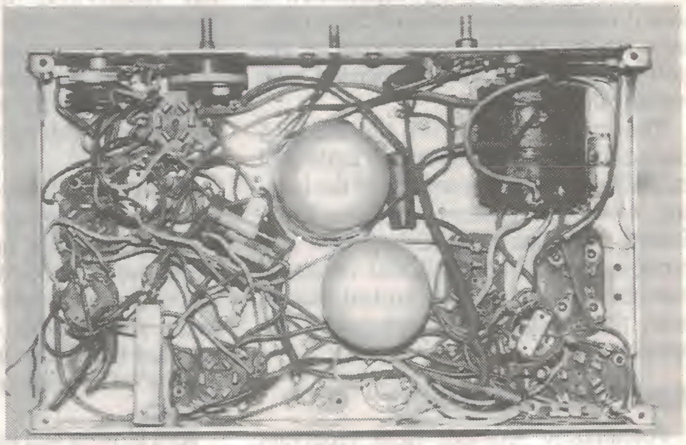
Joining Societies

Regardless of their ability, and the size of their collections, all vintage radio enthusiasts can benefit from membership of Societies. Both the HRSA and the NZVRS welcome new members, and subscriptions are quite modest.

If you're interested in vintage radio, why not join one — or both. Contact addresses for the two societies are:

Historic Radio Society of Australia,
c/- J.R. Wales,
PO Box 283,
Mt.Waverley 3149, Victoria.

NZ Vintage Radio Society,
c/- The Treasurer,
20 Rimu Road,
Mangere Bridge, Auckland. ■



Left: the dial escutcheon of the model 627 illustrates the attention to detail that was a characteristic of Atwater Kent receivers. Right: first impressions of an Atwater Kent chassis are of a disorderly jumble of wires, but closer inspection shows that in reality there has been a lot of planning. Most of the bypass capacitors are in the rectangular box at lower left.

EA with ETI marketplace

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FORUM

Continued from page 60

filtered signal, then a switch-type demultiplexer would indeed give a perfect reconstruction of the original L and R signals — without any need for special jiggery-pokery.

Or failing that, I suspect that if we were to use a sampling-type decoder, with narrow gating pulses to sample only the peaks of the composite signal's half sinewave pulses, we'd also get cleaner decoding. But perhaps I'm wrong.

Further paper

By the way, our shy reader B.R. also very kindly sent in a copy of another paper on the subject, written in 1964 by J.G. Spencer and G.J. Phillips, and published in the UK learned journal *The Radio and Electronic Engineer*. Mr Spencer and Dr Phillips were at that time engineers working in the Research Department of the BBC, and had done a survey of the various proposed systems for FM stereo, before writing the paper — which is entitled 'Stereophonic Broadcasting and Reception'. It deals mainly with the Zenith-GE 'pilot tone' system, though, and also presents an analysis of time-domain multiplexing and demultiplexing.

The authors of the paper do make clear why the 'out of phase crosstalk' of a basic switched demultiplexer arises:

This is a fundamental result of applying the square-wave switching to the signal, but the crosstalk can be compensated by passing the multiplex signal through a network which attenuates the sum signal by a factor of 2/π relative to the difference-sideband signal...

There doesn't seem to be any doubts as why the problem arises, then, or how to fix it. But I for one am still not sure *exactly* how it occurs. Perhaps I'm just being a little dense here, though.

Anyway, that's about all we have space for this month. My thanks to all of the readers who responded to this subject, and sent in so much helpful information.

I hope you'll join us again next month, as we crack open our first discussion/debate/argument for 1992! ■

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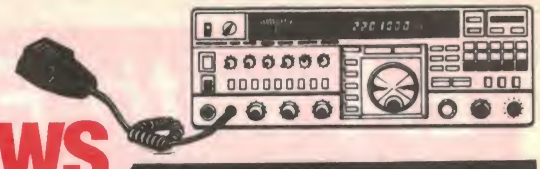
Amateur Radio News



New records for 6m contacts

In the latest issue of *Amateur Radio* to reach our office, the chairman of the WIA's Federal Technical Advisory Committee (FTAC) John Martin VK3ZJC announced five new records for 6m contacts by Australian amateurs.

Three of these were for 'long path' contacts, which were not accepted in the past because it was believed they were not recognised internationally. This is apparently not so.

Most impressive of the new records was that by VK3OT, with a contact to 9Q5EE on April 6 — a distance of 27,186km, which establishes a new national record.

Then comes a contact between VK4ZAZ and 6W1QC on March 2, a distance of 21,741km, establishing a new VK4 record, and also a contact by VK2BBR and 6W1QC on the same day, over a distance of 21,384km for a new VK2 record.

The other two contacts were between VK1RX and KP4A on April 8, a distance of 16,082km which sets a new 6m record for VK1; and between VK2ZAZ/M and FM5WD on April 6, a distance of 16,243km which sets a new record for mobile operation.

Congratulations to all of these amateurs; they're very impressive achievements.

Useful tool, or dangerous weapon?

We also noted in the same recent issue of *Amateur Radio* a short but interesting article by Tom Allen VK7AL, describing a useful gadget to assist hams in hoisting temporary antennas — for field days and emergencies.

The device is a neat little hand slingshot or 'catapault', designed to allow convenient propulsion of a stone (with fishing-line attached) over a suitable tree or other object.

A good idea, to be sure, although as the author himself points out, the device is also potentially quite dangerous. He notes as well that it may not be legal to use such a device in some states, as the authorities may well regard it as a dangerous weapon.

AR's editor comments at the end of the article that currently Victoria *does* allow amateurs to use such a device, for the intended purpose. However the legal position in other states is not known.

Obviously such a device should be used very carefully, to ensure that there is no risk of injury to people or animals. However when used in this way, it would not only be fast and efficient, but also 'environmentally friendly'.

And after all, almost *anything* can be used as a weapon in the hands of someone bent on aggression...

VK2RWI's 23cm repeater now A1

As noted in last month's column, Dick Smith Electronics recently made another donation of equipment to the VK2 division, to improve operation of its 23cm repeater at Dural. The equipment was a pair of high-gain vertical antennas, to provide improved coverage of the repeater on its frequency of 1281.750MHz.

Apparently when the new antennas were first installed atop the 100' tower, some desensitising was noted.

However according to a recent VK2 news broadcast Tim Mills VK2ZTM subsequently climbed up the tower, and discovered that the problem was due to a faulty co-ax connector. This was soon replaced, and the repeater is now operating as well as expected.

No licences 'over the counter'

The VK2 Division of the WIA has recently been advised by the DoTC licensing people to the effect that 'under no circumstances will licences be issued over the counter', and has been asked by the Department to convey this to candidates for the Amateur licence examinations.

Apparently the Department is not set up to handle the issuing of licences 'on the spot'. Successful candidates should therefore note that they must either post in their licence applications, with the appropriate fee, or drop them into the nearest DoTC office and then wait for them to be processed and returned by mail.

There is no faster way, it appears. ■

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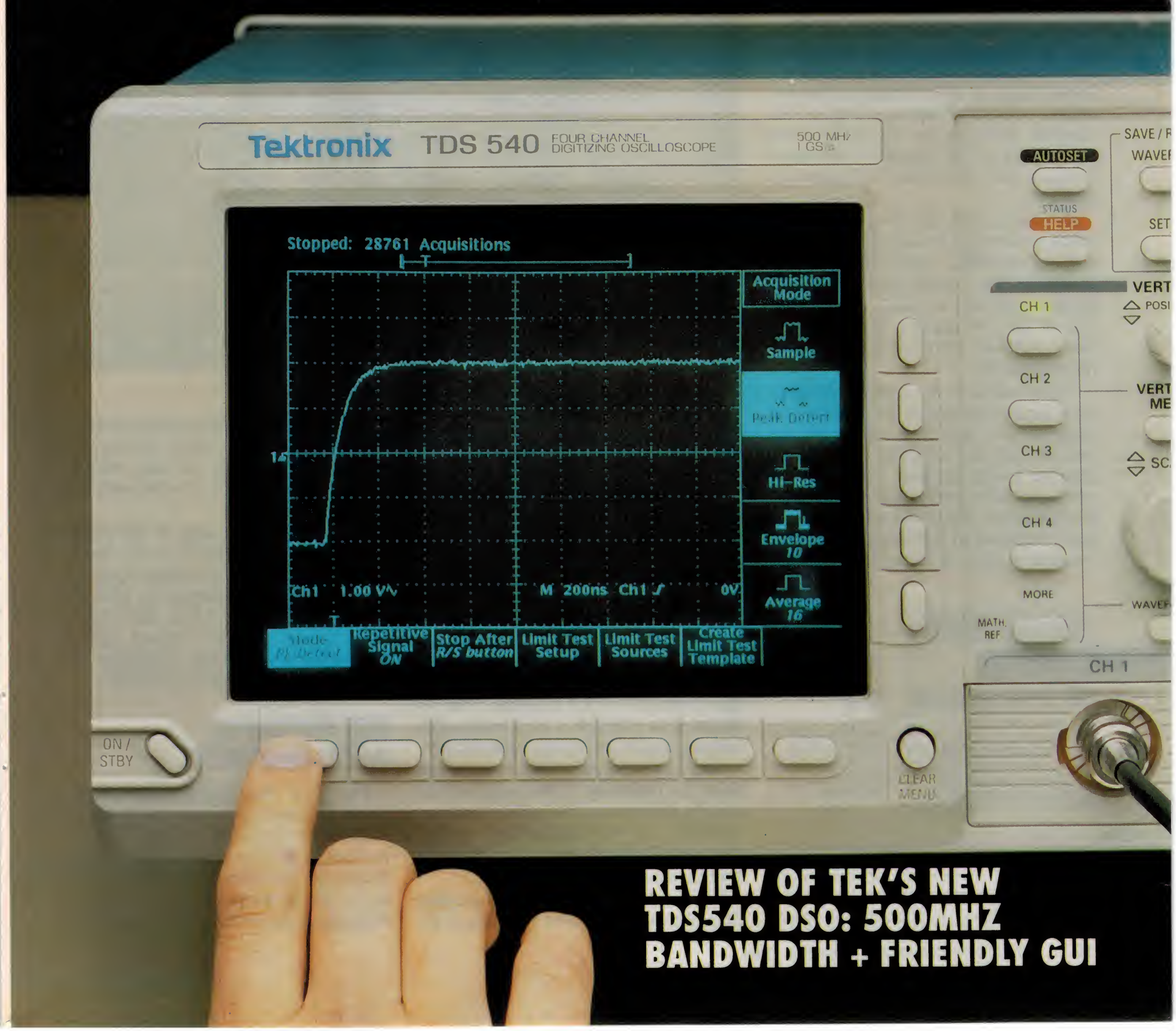


REVIEW OF TEK'S NEW TDS540 DSO: 500MHZ BANDWIDTH + FRIENDLY GUI

NEWS HIGHLIGHTS

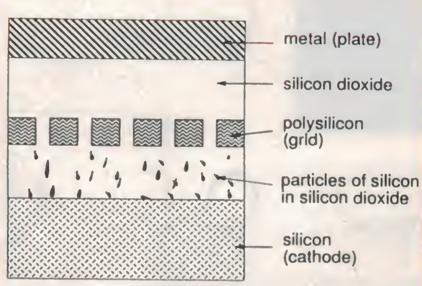
UNSW RESEARCHER'S QUASI-VACUUM CHIP

Despite the success of conventional bipolar and MOS technology, there is continuing interest among the world's semiconductor researchers in devices based on the field-emission and tunnelling mechanisms — as were used in thermionic valves. Such devices offer the advantages of 'radiation hardness', and also the ability to operate at much higher voltages.

Some progress has been made with 'vacuum chips', using virtually the same structure as a valve but miniaturised down to chip level and using large numbers of pointed metal or silicon emitters as a cathode. However a possible breakthrough in the technology has been made by Sik-On (Stephen) Kong, a PhD student working in the Electronics Department of the School of Electrical Engineering at Sydney's University of NSW.

Mr Kong calls his chip design, for which a patent has been applied, a 'quasi-vacuum' transistor. It uses silicon dioxide to replace the vacuum used in previous designs, and has a planar structure so that it can be readily manufactured using standard semiconductor production techniques.

Crucial areas of the device's development include control of the number and shape of the emitting points on the cathode, and also selection of a cathode material having the best work function, while also being compatible with fabrication processes. These and other areas are being explored by Mr Kong as his PhD research project. If successful, the work



could result in devices offering high radiation resistance, combined with the ability to switch up to 10kV at high speed.

NEW OPTICAL FIBRE CABLE FACTORY OPENED

A new facility for the manufacture of optical fibre cables has been built by MM Cables Communication Products, in the Melbourne suburb of Clayton. The factory was officially opened in mid-October by the Hon Kim Beasley, Federal Minister for Transport and Communications.

MM Cables has invested some $15 million in the new building and manufacturing plant, as part of a $27 million development of its Clayton site — designed to establish it as a world-class communication and energy cable facility.

The new plant has been in operation since the beginning of the year, and has already delivered a $16 million order of 3000km of self-supporting optical cable to Thailand telecommunications firm Com-Link.

Delivered on 600 drums each carrying 5km, the cable contained 40 fibres in all, each capable of carrying the equivalent of 8000 metallic cable voice circuits. All deliveries were made on time, and the plant received a letter of commendation from Com-Link.

The optical fibres used in the plant's cables are manufactured at the nearby facility of Optical Waveguides Australia, jointly owned and operated by MM and Dow-Corning of the USA. MM Cables itself is part of MM Limited, one of Australia's largest public companies and majority owned by BICC of the UK.

AES HONOURS AUST. ENGINEER

The New York-based international Audio Engineering Society has honoured Australian engineer Neville Thiele, formerly Director of Engineering Development for the ABC, Past President of the IREE Australia and well-known throughout the world for his work with

Dr Richard Small on loudspeaker enclosure design.

Already a Fellow of the AES, Mr Thiele has now been elected as Vice-President for its International Region. This is acknowledged as a high honour, as the Society has only five VP's — three for the USA and one for Europe, apart from the International Region. The latter includes Australia, Japan, India and the rest of the Asian region.

NEW DESKTOP I/O BUS FROM I^2C

Digital Equipment Corp and Philips/Signetics have announced details of a new low-cost ACCESS bus for local interfacing of low speed peripheral devices to desktop workstations and PC's, based on Philips' highly successful I^2C microcontroller chip interconnection bus.

The new ACCESS bus is an open serial bus which can support up to 14 peripherals such as keyboards, hand-held scanners, mice, joysticks, trackballs and graphics tablets, in a plug-and-play environment. It offers the ability to swap devices without rebooting, coupled with data rates of up to 80 kilobits per second, and can link devices over distances of up to eight metres (26 feet).

Like the I^2C bus, ACCESS is essentially a two-wire bus with the two signal wires used for clocking and data respectively. However in practice two further wires are used, for +12V and ground. Total current drain allowable via the bus for use by peripherals is 500mA. The standard bus connector is a shielded rectangular four pin connector.

The ACCESS bus uses an open protocol, the information on which will be available from Philips/Signetics and DEC free of charge. According to a DEC spokesperson, users will be able to plug an ACCESS-based peripheral directly into the bus and start working, without any need for loading device-specific drivers or adjusting DIP switches.

INMARSAT PLANS GLOBAL POCKET SATELLITE PHONES

Inmarsat, the 64-member country mobile satellite communications organisation, has announced its Project 21 initiative to plan and implement the systems needed to provide for the global mobile satellite communications requirements of the next century.

Explaining project 21, Inmarsat's Director General Olof Lundberg said that its basic aim was to provide a world-wide, go-anywhere, pocket-sized satellite phone service by the end of the decade.

"But of course, this could and will be extended to many more applications. For instance satellite voice, data and entertainment communications centres for your car, personal satellite navigation, position reporting and alerting services for your security," he said.

"Imagine the impact of tiny, multi-purpose communicators — units that can be slipped into a pocket or handbag but will work clearly and reliably anywhere in the world — on our business and social lives."

Next year, Inmarsat will offer a new low cost global phone service to terminals the size of a briefcase and the following year a global alpha-numeric satellite paging system. It is currently launching its Inmarsat-2 series satellites and has already contracted for larger Inmarsat-3 spacecraft, due to begin launching in 1994. The target cost of the hand-held voice terminal equipment is to be less than US$1000.

LOCAL MFG OF TFT-LCD MONITORS

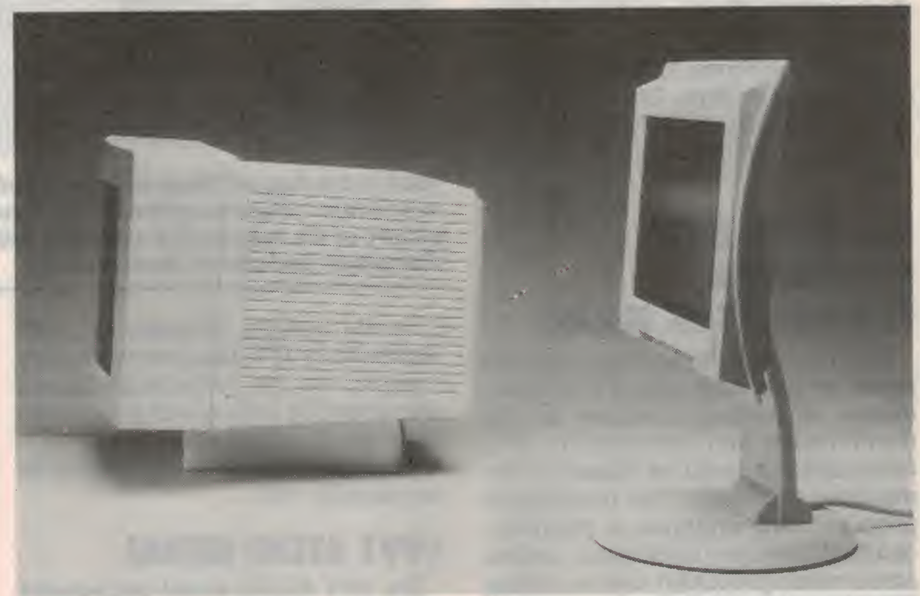
Keycorp and Hitachi Data Systems have launched a new Australian company to manufacture flat-panel LCD computer screens in Sydney and market them both locally and overseas.

The two companies decided to form Flat Screen Technologies after working successfully together for the last 18 months on the development of the new product. Under the agreement, Keycorp will provide design and development expertise while Hitachi Data Systems will provide funding and marketing assistance. The new monitors take advantage of Hitachi's thin-film transistor (TFT) and liquid crystal display technology to achieve a size roughly that of a telephone book, and only half as thick.

As well as being compact, they are said to be free from flicker and to provide greater clarity than traditional CRT screens.

All monitors have a 10" diagonal screen and are claimed to offer VGA resolution (640 x 480 pixels).

Two colour models will be available, one featuring active-matrix TFT technology and the other passive matrix. A third model offers high contrast mono display.



IBM EXPORTS REACH $1 BILLION

The australian computer industry passed an historic milestone with the announcement that IBM Australia has achieved total exports worth $1 billion — the first company to do so.

The Minister for Industry, Technology and Commerce Senator John Button, said IBM had reached the $1 billion figure just seven years after it began exporting from Australia.

The company estimates it will reach $4 billion in exports by the year 2000.

"The $1 billion milestone export is a RISC System/6000 computer destined for a customer in Japan," he said.

"It was manufacturerd and pre-loaded with customised software at IBM's plant at WangarattainVictoria.

This is a great achievement for a plant which was opened as a typewriter factory in 1976.

OPPORTUNITY FOR OVERSEAS TRAVEL/STUDY

Travel overseas for about three months with airfares paid, a living allowance and fee allowance are available to those awarded a Churchill Fellowship. The average Churchill Fellowship is worth about $12,000.

To date nearly 1600 Australian residents have taken this opportunity and brought back knowledge and skills for the enrichment of Australian society.

Churchill Fellowships are available to all Australians regardless of academic or other qualifications.

To apply for a 1993 Churchill Fellowship, send a self-addressed stamped envelope 24 x 12cms to:

Application Forms, The Winston Churchill Memorial Trust, 218 Northbourne Avenue, Braddon, ACT 2601.

Applications close on 28 February 1992.

Back in the August issue we gave details of Sony's new mini CD system, which uses 64mm magneto-optical discs to record high quality audio. At that stage no picture of the system was available, but at last we have a picture of the portable disc player and one of the disc cases.

RAMTRON & ITT DEVELOPING FERROELECTRIC MICRO

Ramtron International Corporation has signed an agreement with ITT Semiconductors of Freiburg, Germany for the development and manufacture of a microcontroller based on Ramtron's ferroelectric technology. The development program will integrate a Ramtron-designed 256K-bit ferroelectric random access memory (FRAM) with an existing ITT 8-bit microcontroller.

The resulting single-chip microcontroller is planned to be the first of a new class of ferroelectric microcontrollers with memory that can be dynamically updated in the field and remain nonvolatile without battery backup. The microcontroller product development agreement is a follow-on to the ferroelectric technology co-development agreement signed by the two companies in 1988.

"The use of the ferroelectric RAM in a single-chip microcontroller will allow electronic systems to be readily upgraded with new features in the field and to adapt automatically to changing user requirements," explains Richard Horton, Ramtron's president.

"We expect the adaptive capability of the ferroelectric microcontroller will be very useful in a wide variety of consumer, industrial, telecommunication, automotive, and computer applications."

Under the terms of the agreement, the ferroelectric microcontroller will be manufactured at Ramtron's Class 1 submicron, 6" wafer fabrication facility in Colorado Springs, Colorado and sold worldwide by ITT. Ramtron will receive royalties on the ferroelectric-based microcontroller sales as well as payments for product development.

The microcontroller is scheduled to be introduced in 1992.

1991 ATERB MEDAL

The 1991 ATERB Medal was awarded to Dr Rick Middleton, Lecturer in the Dept of Electrical Engineering and Computer Science at the University of Newcastle.

The award, a silver medal and a prize of $2500, recognises outstanding contributions in the fields of telecommunications and electronics by a young Australian. Such contributions can be recognised by research papers, patents, commercial success and benefit to Australia. It is awarded jointly by the Australian Telecommunications and Electronics Research Board (ATERB) and the Australian Academy of Technological Sciences and Engineering.

Dr Middleton is distinguished for his contributions, which range from advanced theory through to engineering practice. His theoretical contributions cover the areas of robotics, digital control design, adaptive control, signal processing and numerical analysis. These contributions won Dr Middleton international recognition and he is one of the very few Australians who have been selected as an Associate Editor of an IEEE Transactions Series.

He is the co-inventor of an entirely new approach to computer control systems and has published this approach in a recent book which promises to become the standard text in the field.

NEWS BRIEFS

- Electronic Development Sales, currently the distributor for ***ECQ Electronics*** in Queensland, will now also be its distributor in Victoria.
- Anitech has been appointed by UK-based ***Schlumberger Instruments*** as exclusive Australian distributor for its instrumentation and data logging equipment.
- Senior manager level changes at ***Akai*** include the appointment of David Marshall as General Manager, replacing Gavin Ward; and the promotions of Mark Beard to Marketing Manager and Peter Whipps to Major Account Manager.
- At the recent ***Computer Expo*** held in Brisbane, Mr Graham Palfrey the Technical and Development Manager of Viscount Plastics in Carole Park was the lucky winner of a free subscription to *Electronics Australia*. Mr Palfrey will begin receiving his subscription copies with the January issue.

JAPAN TECHNOLOGY MISSION VISITS CIMA

CIMA Electronics recently played host to 22 representatives from some of the leading Japanese high technology companies, as part of an initiative between the Dept of Manufacturing, Industry and Development (DMID) and the Japan External Trade Organisation (JETRO) to encourage and promote industrial cooperation between Australia and Japan.

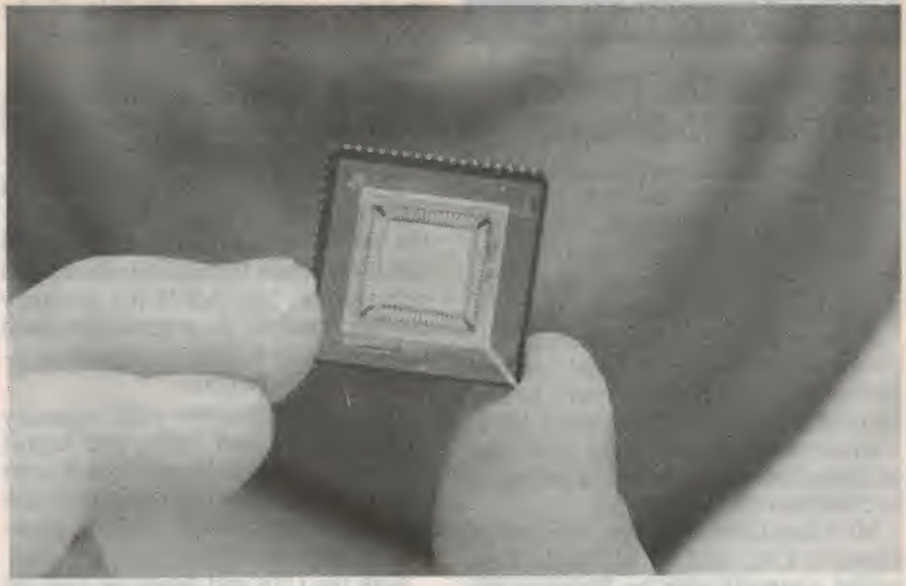
Major objectives of the mission included technological exchange, joint research and development programs, OEM transaction and the establishment of joint ventures between Australian and Japanese manufacturing companies.

The official welcome to Victoria included a lavish reception at the Windsor before getting down to business with a full schedule of visits to Victorian high technology companies.

Ron Tripp, Managing Director, CIMA, officially welcomed the group before presenting them with an overview of the philosophies of CIMA, which was followed by a tour of the facilities to inspect the ASIC Laboratory and SMIT Facility.

Mr. T.J. Polkinghorn, General Manager TCG-ILID also demonstrated the ILID Supermarket Shelf Labelling System being developed by CIMA under contract to TCG-ILID.

This revolutionary technology enables the user to change the information on a supermarket shelf label by modulating the fluorescent lights overhead.



Researchers at Edinburgh University in Scotland have integrated a CMOS image sensor with all of the other devices needed to produce a complete monochrome video camera on this single chip (8mm square). The sensor section is said to be between 10 and 100 times cheaper than existing CCD types, and is the subject of a number of patents. Total chip dissipation is only 100mW.

TRAINING COURSES VIA SATELLITE

A new scheme to deliver industrial training which qualifies for eligibility under the Training Guarantee Act has been launched in NSW by the TAFE Open College Network, in association with Acesat Satellite Corporation.

The newly formed Direct Broadcast Network (DBN) will provide courses live via AUSSAT, directly to employers and employees at their places of work.

Live talkback will be provided via 008 phone and fax numbers. The training courses will take four hours of the working week — two of interactive TV, and two of printed work, providing employers with a more practical, effective and productive way of training their staff.

Initially DBN will offer courses built around basic business practices and use of popular software packages.

Additional courses will become available as the network develops and demand increases. The courses will be conducted by fully trained TAFE teachers and TAFE Statements of Attainment will be awarded to successful students.

Further details are available from DBN on (02) 526 2411 or fax (02) 526 2206.

TI OPENS R&D IN JAPAN

Texas Instruments has become the first US-based commercial semiconductor company to open a dedicated research and development centre in Japan.

The centre is designed to strengthen TI's technology base in semiconductors and systems worldwide, and also to give TI insights into next generation technology and market requirements, in areas such as consumer electronics, in Japan and the Asia-Pacific region.

The 240,000 square foot, six story Tsukuba Research & Development centre is located at Tsukuba (Science City), Ibaraki Prefecture, 40 miles northeast of Tokyo. Construction of the Centre began in 1989.

"This R&D Centre demonstrates Japan's importance to TI's global strategy. With more than half of the world semiconductor market today in Japan and the Asia-Pacific, it is vital that TI have technology resources in the region and close to customers," said TI Chairman, President and CEO Jerry R. Junkins, who was in Tsukuba for the opening of the Centre.

"We want to develop technology for the next generations of systems, including consumer electronics products.

Today 42% of the consumer electronics market is in Japan, so it is imperative that we have R&D capability there in order to participate in this market.

The Tsukuba Centre will conduct basic and applied research in such areas as solid-state sciences, computer sciences and systems technologies.

LOWER COST TDS SCOPES FROM TEK

Tektronix Australia has announced an extension of the easy to use TDS platform to a new line of low cost portable DSO's.

The new TDS 400 Series Portable Digitising Oscilloscopes offer the same intuitive operation, responsive acquisition capabilities, and powerful computing engines as the recently announced TDS 500 series, while yielding slightly reduced performance at significantly lower cost.

The initial TDS 400 series offering will consist of two products, the TDS 420 and the TDS 460.

The TDS 420 offers 150MHz bandwidth and the TDS 460 offers 350MHz bandwidth.

Both products are four-channel instruments equipped with four high performance, 100MS/s analog-to-digital converters and selectable 500-to 5K points record lengths per channel (with an option to extend record lengths to 30K per channel). Both new instruments offer 8-bit vertical resolution and 1.5% accuracy.

The TDS 420 is priced at $5995, while the TDS 460 is $7495. ■

$150M ANZAC FRIGATE CONTRACT TO SIEMENS

Siemens has signed a contract to supply ship's electrical and electronic systems to AMECON, the Williamstown based builder of the 10 ANZAC frigates for the navies of Australia and New Zealand.

Siemens will begin work immediately on the design of the electrical systems, although the first frigate will not be handed over to the navy until 1995, with the tenth scheduled for 2004. The estimated contract value is in excess of $150million (at 1988 prices).

Mr Klaus Lahr, Managing Director of Siemens Ltd, said, "This is the first major contract won by Siemens for marine engineering in this part of the world. As big as this contract is in its own right, we plan to use it as a springboard to help establish a locally based, world competitive, marine engineering industry."

Signing on behalf of the ships' builder, Dr John White, Chief Executive of AMECON said, "The close relationship established between Siemens and AMECON over the last three years, and now cemented by the signing of this subcontract, is an essential foundation for the success of the ANZAC ship project and provides an excellent opportunity for Australian and New Zealand industry.

NEW GROWTH FOR WORLD SEMI MARKET

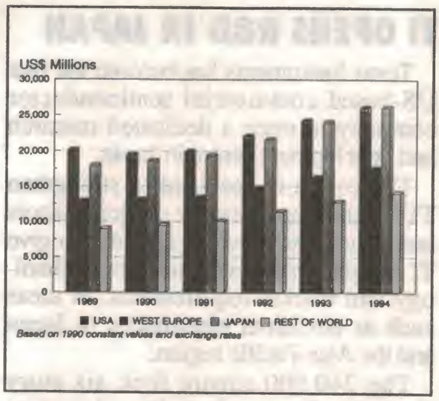
The world's semiconductor market was set to experience substantial new growth by the end of this year, continuing on to the mid 1990s, according to a new report — 'Profile of the Worldwide Semiconductor Industry — Market Prospects to 1994.'

The slowdown of the semiconductor market began in the second half of 1989 and continued into the first half of 1991.

But the Report predicts that the first signs of recovery should be evident by the end of 1991, as growth in the world economy feeds through to electronics companies, and ASPs for memory products stablise. As a result the world semiconductor market is forecast to increase by 3.5% in 1991.

With a more buoyant world economy in both 1992 and 1993, the Report forecasts the world semiconductor market will go on to increase by 11.5% and 10.7% respectively, before slowing to 8.2% in 1994.

Both the USA and Japan are forecast to lead the recovery in the next few years. In the USA, the recovery of the computer industry is expected to spearhead growth in the semiconductor industry, resulting in an increase of 11% in 1992, slowing gradually to 7.2% in 1994, reach US$26 billion. In Japan after modest growth of 3.9% in 1991, in part due to weaker domestic demand, the Report forecasts an increase of 11.8% and 11.2% in 1992 and 1993 respectively.



This growth is forecast to slow to 8.5% in 1994. Full market data is available in the report published by Elsevier Advanced Technology which also includes a detailed directory of over 500 plants worldwide, as well as information on more than 150 new plans and expansion projects.

For further information contact Elsevier Advanced Technology, Mayfield House, 256 Banbury Road, Oxford, OX2 7DH, UK; fax (+44) (0) 865310981.

NSW INTRODUCES SERVICING CODE

NSW Minister for Business and Consumer Affairs Gerry Peacocke has launched his department's final Advisory Code of Practice for the Domestic Electronic Servicing Industry.

The new code is designed to help minimise disputes with consumers, by defining acceptable codes of practice.

The code has been developed by industry members, the Dept of B&CA and the Trade Practices Commission, as a guide for TV, VCR and sound equipment repairers.

By adhering to it, they will be able to deliver a high standard of service and avoid the relatively high consumer complaint levels of the past.

It is also expected that the code will assist consumers by indicating what they should expect from repairers who come to their homes or take appliances away to be serviced.

The code may also be used to help mediate in disputes. Although advisory, many of the guidelines outlined are in fact, interpretations of the application of general law, such as the Fair Trading Act and the Trade Practices Act.

Organisations involved in finalising the code include CESA, TESA, ESIA and TETIA. ■

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Model	MX20	MX50	MX51	MX51EX	MX52	MX52S
Basic Accuracy	0.5%	0.5%	0.1%	0.1%	0.1%	0.1%
Bargraph		●	●	●	●	●
Zoom Mode[1]		●	●	●	●	●
Zero Mode[2]		●	●	●	●	●
Live Trend Memory[3]		●	●	●	●	●
Logic Function		●	●	●	●	●
Min/Max Recording			●	●	●	●
Store 5 readings			●	●	●	●
Relative Mode			●	●	●	●
RMS Conversion					●	●
Frequency					●	●
dB level					●	●
High Accuracy(0.1%) 4-20mA				●		●
Intrinsic Safety				●		
EEx ib IIC T6						
HBC fuse protection	●	●	●	●	●	●

1. Zoom mode gives 5x magnification 250 segment sliding scale bargraph display
2. Zero mode functions as centre-zero meter for rapid polarity change measurements and zeroing
3. Live Trend mode digital display shows stored value, bargraph shows absolute value (ie simultaneous display of current and stored values)

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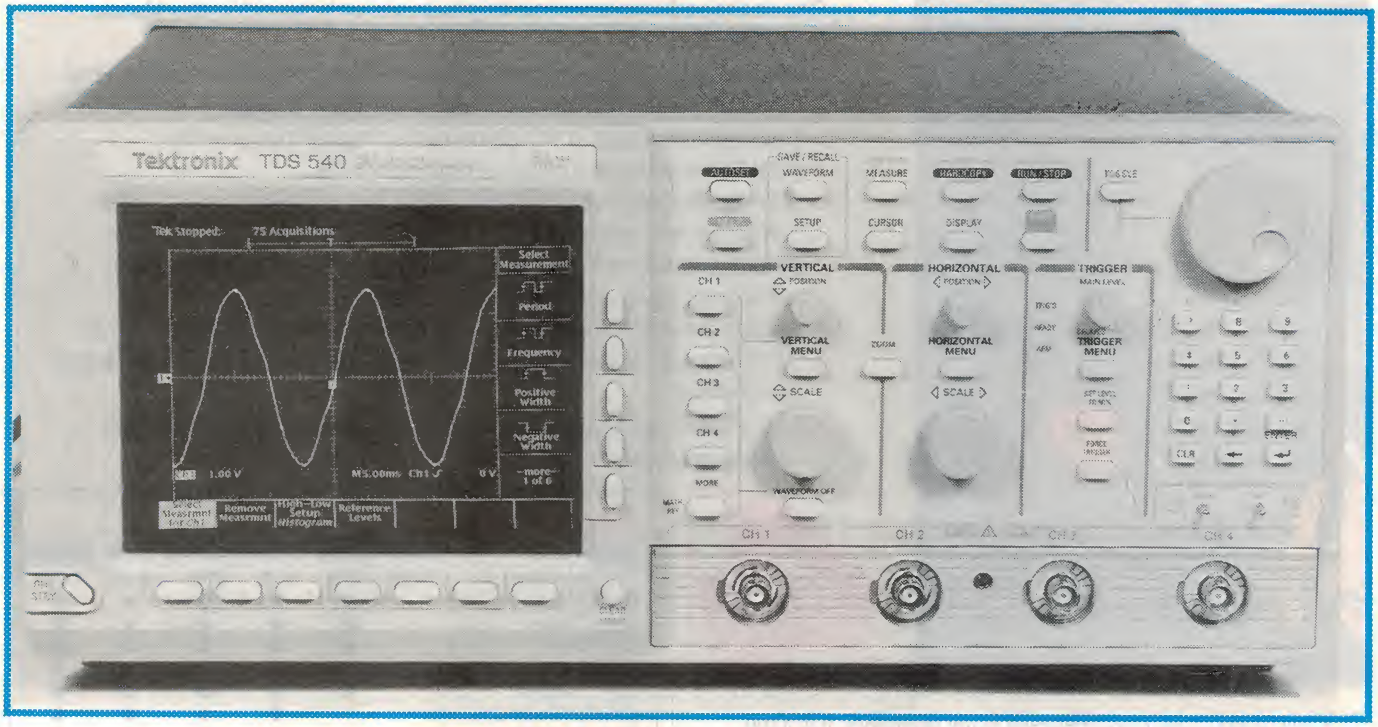


Tek's new TDS540 1GS/s digital scope

A few months ago, Tektronix released the first two models in a new range of 'next generation' digitising scopes, the TDS500 series. We've now had the opportunity to try out one of the new top of the range TDS540 scopes for a few days, and here's what we found.

by JIM ROWE

At a recent press conference to launch the new TDS500 series of DSO's, Tektronix Australia's sales engineers explained that the company's R&D people back in the States had put a great deal of time and effort into their development. Not just into achieving the highest possible performance, they explained — although the new scopes certainly leave very little to be desired here, as I'll explain shortly. No, in this case it was also a matter of striving to ensure that the new instruments really did meet user needs and expectations, in terms of functional features and operating convenience.

In fact, we were told, Tektronix had carried out unusually extensive surveys of both existing users and intending scope buyers, to find out exactly what they all wanted in terms of facilities and ease of use. So the new TDS500 series instruments have been virtually 'designed by the customers', in terms of these features at least, it would seem. This sounds a very commendable move, although many companies have made similar claims in the past and we're all probably a little cynical about them nowadays. The old 'proof of the pudding' test is still the ultimate one, of course.

I have to confess, though, that Tek's new DSO's do indeed seem to embody a lot of functions that are very practical and useful, and also seem to be rather more 'user friendly' than quite a few others I've tried in the past (no names, no pack drill!).

Mind you, some of the first generation of DSO's from *many* of the makers were strikingly unfriendly instruments, and were also rather limited in terms of their available functions. This plus their very high prices tended to give DSO's a pretty bad image for quite a while — which perhaps didn't matter much at first, but was obviously going to become a prob-

lem once the technology developed and made it possible to produce cheaper models that needed to appeal to a broader range of users. I can well understand that reputable makers like Tektronix would want to do everything they could to make sure that their new models would shatter the old DSO image, and create a new one to replace it...

But enough preamble, and down to specifics. What kind of scope has Tek actually produced, as a result of this extensive effort?

High performance

In terms of raw performance, the TDS540 is certainly quite impressive — offering the kind of data acquisition capabilities previously only available on instruments such as the Tek 11000/DSA series. It has four full vertical input channels, each with 500MHz bandwidth for *both* 50-ohm and 1M input impedance, and with a maximum sensitivity of 1mV/division (min. 10V/div).

Matching the inputs are four identical 8-bit A/D converters, each offering 1% accuracy and operating at a sampling rate of 250MS/s. These are fully independent and able to operate simultaneously — normally with one to each input. However the converters can also be combined via time interleaving and applied to fewer input channels, to give higher real-time sampling rates. Thus if only two channels are required, each can make use of a pair of A/D's, to give sampling at 500MS/s. Similarly for single channel measurements all four A/D's can be combined to give 1GS/s sampling — all at the touch of button.

Note that unlike many DSO's, where the input A/D's operate at various sampling rates depending upon the timebase range selected, with the TDS540 they always operate at the maximum rate. Down-stream multiplexers are used to perform rate conversion before the data is stored in the capture memory, with built-in 'intelligence' to select and/or process the data samples before storage.

The capture memory provided for each channel is user-selectable between 500 and 15,000 data points in the basic instrument, with expansion to 50,000 points available as an option. This allows the capture and analysis of both single-shot and repetitive signals in considerable detail. The instrument's high sampling rate and long memories also facilitate a 'zoom' display mode, which allows waveform expansion and examination of signal details.

The TDS540 provides five different 'acquisition' or data processing modes, as part of its capture flexibility. In the most basic (and default) **Sample** mode, many of the incoming samples are simply discarded as part of the necessary rate conversion between the A/D sampling rate and the number of data points which can be displayed on the screen, at the timebase rate concerned.

Hence if the timebase rate is such that only one-fifth of the incoming sample data can be used (because of memory length and display resolution limitations), four samples in every incoming group of five from the A/D's will be discarded.

As this mode can cause narrow pulses or 'glitches' to be missed, especially at lower timebase speeds, Tek has also provided a proprietary **Peak Detect** mode for single waveform acquisition, wherein the highest and lowest sample values in any incoming sample group are always captured and displayed, to ensure that peak details are not lost. A similar **Envelope** mode operates for repetitive waveform acquisition.

There's also a **Hi Res** mode for single waveform acquisition, in which the displayed data point value is produced by averaging the values of all samples in the incoming data group. This reduces the apparent noise, and combines the speed of real-time sampling with the benefits of averaging. The TDS540's final **Average** mode performs the same function for repetitive waveform acquisition.

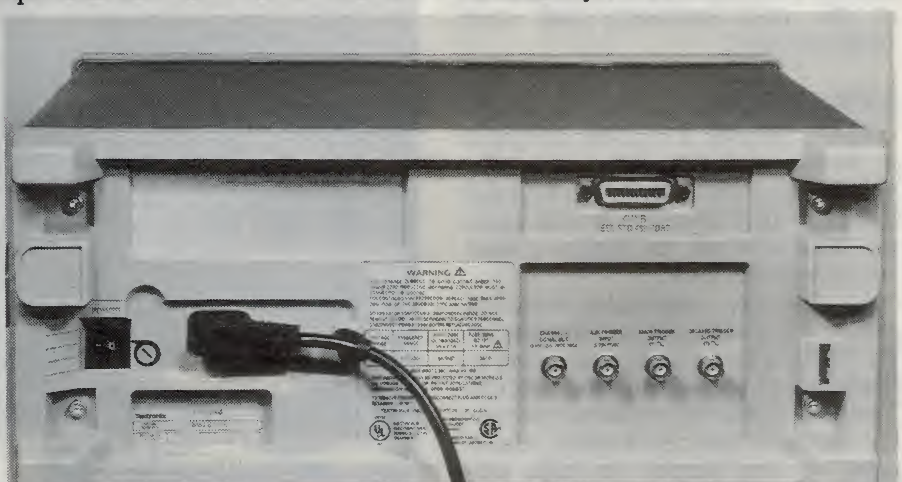
For real-time sampling, the TDS540 offers a choice of either no interpolation ('just the dots'), or interpolation using either a *linear* or *sinX/X* algorithm.

The TDS540 offers (random) equivalent-time as well as real-time sampling, of course, and automatically switches between the two depending upon the timebase range selected and the number of channels in use (which determines the actual real-time sampling rate). The equivalent-time sampling rates vary according to the same criteria, from an available range from 500MS/s to 100GS/s.

The instrument is provided with both main and delaying timebases, with the main timebase able to be set to speeds from 10s/div to 500ps/div. The corresponding range for the delaying timebase is from 250s to 4ns.

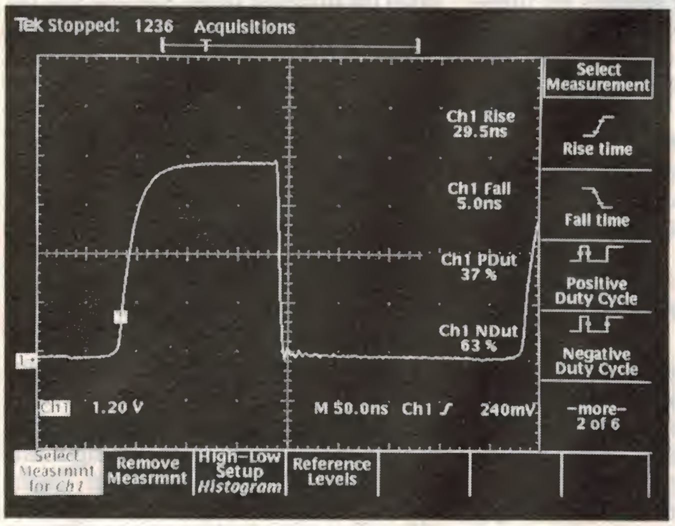
The triggering facilities are very comprehensive, as you'd expect. As well as the usual selection of input coupling modes and polarity, there are eight different kinds of qualification for 'logic' type signals (on the basis of both pattern and state), and a further 11 different choices for 'pulse' type signals. These include selection on the basis of pulse width criteria, for 'glitch' capture, on the basis of amplitude criteria for 'runt' capture, or on the basis of timing from a reference point (for missing pulses, etc.).

For trace display, the TDS540 also offers the ability to select either infinite persistence or variable persistence, adjustable over a range from 250ms to 10s. Needless to say, it also offers a very broad range of automated waveform measurements. These include period, frequency, positive and negative width, rise and fall times, positive and negative duty cycle, delay time, burst width, positive and negative overshoot, high/low/maximum/minimum, and six different voltage measurement choices: peak-peak, max-min, mean, cycle mean, RMS and cycle RMS.

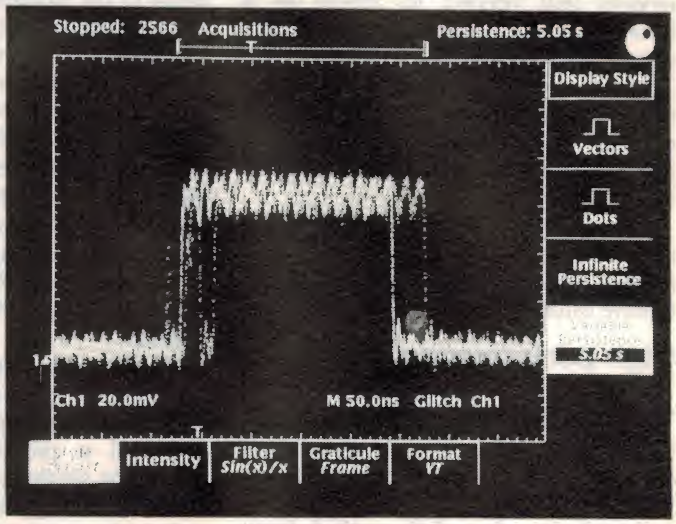


Rear view of the TDS540 showing the GPIB/IEEE 488 interface connector at upper right. The four BNC connectors below it are for channel 3 signal out, AUX trigger input and main and delayed trigger outputs, respectively.

Tek's TDS540 1GS/s digital scope



This screen shot shows some of the TDS540's easy to follow screen menu icons, down the right hand side. It also shows how the instrument displays waveform measurements.



The TDS540 provides a choice of either dots or vector display, with either linear or (sinx)/x interpolation. It also gives either infinite or variable persistence, as shown here.

Incidentally the TDS540 has a GPIB/IEEE 488.2 parallel interface for interconnection to a computer or other instruments. Video display resolution is 640 x 480 pixels (virtually the same as VGA on a PC), in a display area measuring 132 x 100mm.

I should also mention that like the other members of the TDS500 family, the TDS540 contains no less than *three* fast microprocessors: a proprietary 32-bit 'TriStar' processor which handles all of the digital filtering, interpolation, signal averaging, waveform maths and other computing-intensive tasks, a display processor and a Motorola 68020 running at 16MHz which looks after all of the user interfacing and other 'housekeeping'.

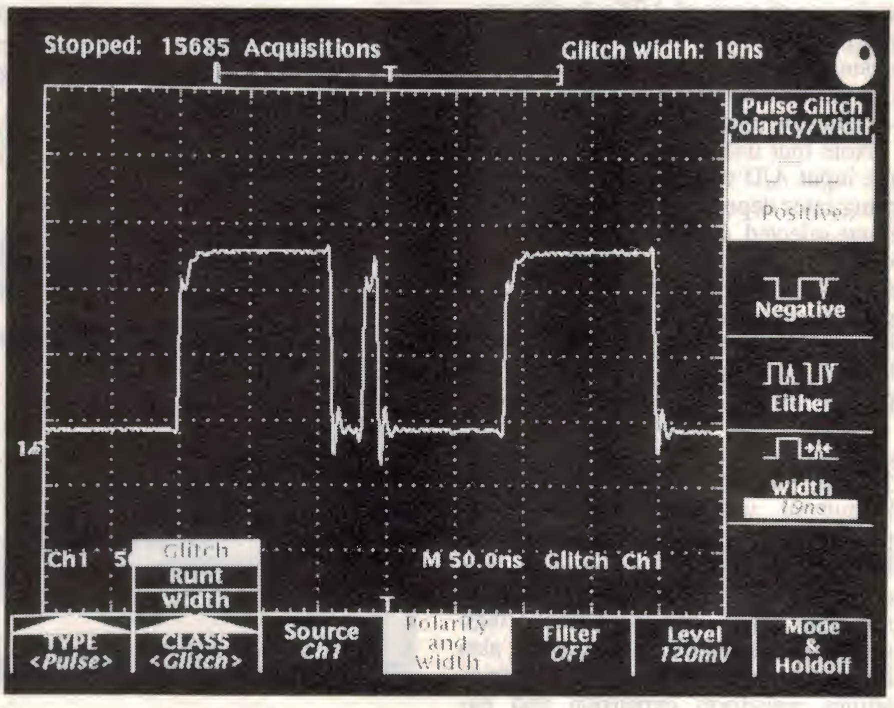
Ease of use

So the TDS540 is certainly no slouch in terms of performance. But after you've used it for a while, you find that the things that impress you most about the instrument are its logical control layout and ease of use.

All that user consultation Tektronix carried out during the development of the TDS500 series really *does* seem to have paid off, judging from the TDS540. There's no doubt that it's an exceptionally convenient and 'user friendly' instrument to use, despite its high performance and the large number of facilities it provides.

How has this been achieved? Well for a start, the control layout strongly resembles that of a familiar analog instrument, with dedicated controls for the main adjustments like vertical sensitivity and timebase speed. It's true that in this case the controls often operate slightly differently to those on an analog scope (for example there are buttons to 'select' which channel the single vertical sensitivity knob is to adjust), but the similarity is generally enough to make operation intuitive.

Another important feature is that although the TDS540 uses an array of software-defined function keys, in conjunction with on-screen menues, to perform selection of many secondary functions, Tek has made this system more intuitive than on many DSO's by using *graphical display icons* to clarify the menu options. Some of the icons are visible in the photo's.



Some of the TDS540's extensive triggering mode options are visible in this further screen shot. Here the scope has been set to trigger on a positive-going glitch of less than 19ns width. Note again the intuitive menu icons.

This may not sound a significant feature, but in practice the icons really do make it much easier to negotiate the hierachy of menues that is almost inevitable on any DSO as powerful and flexible as the TDS540. Somehow the icons make it much easier and faster to locate the function or option you need, by augmenting the necessarily brief text labels for each menu choice. Presumably it's yet another illustration of the old adage that 'one picture is worth a thousand words'...

A further nice feature of the TDS540, from the operational point of view, is a built-in online help facility. Turn this on by pressing the 'Help' button, and then touching any of the controls causes the instrument to display a concise text description of that control's function and use. The facility can then be disabled again, by touching the Help button a second time.

In effect, the TDS540 contains its own user manual, thanks to its inbuilt microprocessor and firmware. It's so logical when you think about it — but why haven't other manufacturers done it yet, with their microprocessor-based instruments?

There are lots of other little user-friendly features, too. For example at the top of the screen display there's an indicator bar which shows not only where the triggering point is located, in relation to the captured waveform data, but also the portion of the captured data that is currently being displayed — very handy when you're in 'Zoom' mode. The TDS540 also shows clearly on screen whether it's currently sampling or stopped, and during sampling it shows the sampling rate currently in use — and whether this is real time or equivalent time. Then when it is stopped, it shows the number of data samples currently in the capture memory.

Another nice little feature is that with the TDS540 there's no need to key in the division ratio of the probes you're using, in order to have it scale waveform measurements correctly. The probes are fitted with custom BNC plugs, carrying extra pins on their flanges. These mate with special sensing contacts around the DSO's input connectors, to inform it automatically. A neat idea, although it does more or less lock you into using Tek's own probes...

Needless to say like most of the latest DSO's, the TDS540 also has one of those great 'Autoset' buttons, which generally gets you a stably triggered display of most unknown signals within a couple of seconds.

Trying it out

We tried out the sample TDS540 in a number of different measurement situations, and with a variety of signals ranging from simple sinewaves from a VHF/UHF signal generator, through pulse generators to typical signals in a microprocessor system. And basically it gave a very good account of itself.

We found it particularly easy to use, thanks to the intuitive control layout and icon/menu 'graphical user interface'. And the overall speed of response to control setting changes was commendably fast, along with the display updating rate. In fact for all settings where real-time sampling is in operation, the response is virtually instantaneous — and almost indistinguishable from an analog scope. Even in the ET mode it's still very fast, with the 'trace cleanup' time only becoming really noticeable on ranges with an equivalent sampling rate of 25GS/s and higher.

The triggering facilities are very comprehensive, especially for dealing with deformed or missing pulses, suggesting that the TDS540 would be particularly well suited for design and/or troubleshooting work in high speed digital circuits.

As far as our test instruments could reveal, the frequency response of the vertical channels extended comfortably to 500MHz in the 'Full' setting, for sensitivity ranges above 5mV/div, lowering to around 350MHz at 2mV/div and 300MHz at the 1mV/div maximum sensitivity setting. Overall linearity and accuracy seemed to be within the rated 1%, while the instrument appeared to have excellent DC offset range.

We particularly liked the speed and convenience with which waveform measurements can be made, the large amount of useful information displayed on the screen, and the ability to 'Zoom' in easily for closer examination of captured waveform details.

In short, then, we found the TDS540 a most impressive instrument, and one that demonstrates very well the capabilities of Tek's new TDS500 series.

The quoted price for the basic TDS540 with two probes is $22,666, plus tax if applicable. An additional pair of probes is available for $615, while the 50K capture memory option costs a further $3180.

Further information is available from Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066. The company also has offices in Victoria, South Australia, Queensland, WA and the ACT. ■

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READER INFO NO. 19

the SPICE TRADE

moves on-shore with a

CIRCUIT SIMULATOR

for the macintosh

featuring:

SPICE compatible file I/O- netlist, output formats

Fully converted to support Mac extended mode

80 bit floating point (12 extra bits of precision)

Mac user interface:

Worksheet allows convenient export of tabulated data to spreadsheets, word processing, plotting and presentation applications

all this, plus

!!! TRADE DEFICIT BENIGN !!!

Version 1.0-2Mb application, (requires floating point), with user guide.

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READER INFO NO. 20

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

First 4Mb NAND EEPROM

Toshiba Corporation has begun worldwide marketing a 4-megabit NAND EEPROM — claimed to be the largest memory capacity ever commercialised in the world for this type of device. Sample shipments of the product, the TC584000, were to start in November, 1991 while mass production will begin in April, 1992.

An EEPROM is a kind of 'non-volatile' memory device — a semiconductor chip that retains programmed data even after the power is cut off. In addition, EEPROMs enable users to erase and program the stored information whenever necessary.

However, the integration level of EEPROMs on a mass production basis has remained at 1Mb which is one-generation behind DRAMs, because of the complexity of the memory cell structure. Toshiba's new EEPROM adapts a new NAND cell to overcome this hurdle to integration. Consequently, the new EEPROM is 70% of the size of the company's conventional 4M DRAM chips.

The new device can either erase all information stored in the chip at a time, or erase any 4KB of information. The chip also achieves single 5V operating voltage by using tunnel phenomena, as well as by incorporating a circuit which generates the necessary high voltage to erase and program the information.

TV IF chip simplifies alignment

Motorola has introduced a monolithic IC that functions as a single-channel TV IF and phase locked loop (PPL) detector system for all standard transmission formats — including NTSC, PAL and SECAM.

The MC44301 was designed with an emphasis on linearity, to minimise sound/picture intermodulation, while greatly simplifying the alignment procedure for the TV.

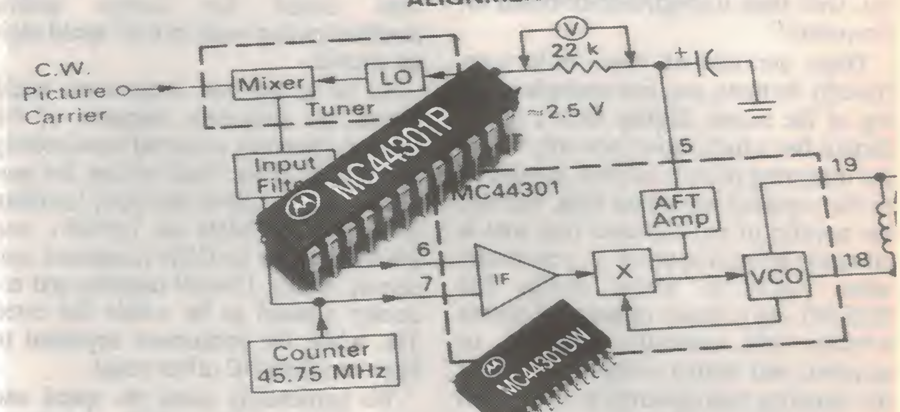
Typical applications include colour television IFs for any standard format, cable TV IFs in set-top converter boxes, enhanced definition or high definition television IFs, and home satellite television receiver IFs.

This device enables the designer to produce a high-quality IF system, including white spot inversion, Automatic Fine Tuning (AFT), and automatic gain control.

The single coil adjustment for the PLL and AFT lowers the manufacturing cost of the end product by allowing a simplified alignment procedure that needs no external phase adjustments.

For more information circle 277 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 887 0711.

ALIGNMENT CONFIGURATION



High power factor pre-regulator

The UC1854 family of integrated circuits provides active power factor correction for power systems that otherwise would draw non-sinusoidal current from sinusoidal power lines. These parts implement all the control functions necessary to build a power supply preregulator which is able to use available powerline current while minimising line-current distortion. To do this, the UC1854 contains a voltage amplifier, a precision analog multiplier/divider, a current amplifier and a fixed-frequency PWM, along with load-enable comparator, low supply detector and overcurrent comparator.

The UC1854 family use average current model control to accomplish fixed-frequency current control with stability and low distortion. Unlike peak current mode control, average current control accurately maintains sinusoidal line current without slope compensation.

The UC1854's high reference voltage and high oscillator amplitude minimise noise sensitivity, while fast PWM elements permit chopping frequencies above 200kHz. The UC1854 can be used in systems with line voltages that vary from 75 to 275volts and with line frequencies across the 50Hz to 400Hz range.

The control boosts the PMW to 0.99 power factor, while limiting the line current distortion to <5%.

For more information circle 271 on the reader services coupon, or contact Priority Electronics, 7/23 Melrose Street, Sandringham 3191; phone (03) 521 0266.

Fast SRAMs are 32 bits wide

EDI is expanding its line of high speed and high density SRAM modules, with new 32-bit wide devices. The two and 8-megabit devices, organised as 64K x 32 and 256K x 32, are designed to meet the needs of commercial 32-bit microprocessors, with fast access times of 20 and 25ns, respectively.

Ideal in primary and secondary cache applications, the modules save significant amounts of board space for

designers through their use of double sided surface mount technology.

For example, a 64K x 32 module can provide as much as a 3:1 space saving over the equivalent memory array provided by 64K x 4 devices, with even greater savings provided by a 256K x 32 module (versus 256K x 4 monolithic devices).

The 2-megabit EDI8F3264C (DIP) or EDI8F3265C (ZIP/SIMM) is based on eight high speed 64K x 4 SRAMs, and the 8-megabit EDI8F32256C uses eight high speed 256K x 4 devices.

Both modules provide four chip-enable lines (one for each set of two RAMs) to allow the system designer to select byte (8 bits), word (16 bits), or double word (32 bits) access.

For further information circle 272 on the reader service coupon or contact K.C. Electronics, PO Box 307, Greensborough 3088; phone (03) 467 4666.

Multiplexers have overvoltage protection

Siliconix has released two new analog multiplexers, the DG458 and DG459, with overvoltage protection and at a cost 25% below that of similar multiplexers.

Both the DG458 and DG459 can withstand overvoltage inputs up to +/-35V. They are designed for use in PC-controlled analog data acquisition systems, industrial controllers, test systems and any similar systems where it is necessary to multiplex external analog sources to A/D converters. The new multiplexers are pin-for-pin compatible with the HI508A/509A and the MAX358/359.

The DG458 is an 8-channel single ended multiplexer, and the DG459 is a differential 4-channel multiplexer. Both are built on Siliconix's silicon-gate CMOS process and offer fast switching speed (250ns maximum), low power consumption (3mW), and low on resistance (1.8k maximum).

For more information circle 273 on the reader service coupon or contact IRH Components, 32 Parramatta Road, Lidcombe 2141; phone (02) 748 4066.

Floppy disk controller chip

Arizona-based VLSI Technology has released the VL82C110 Floppy Disk Controller (FDC) Combination chip.

The VL82C110 is a high-integration chip that replaces several of the commonly used peripherals found in PC/AT compatible computers.

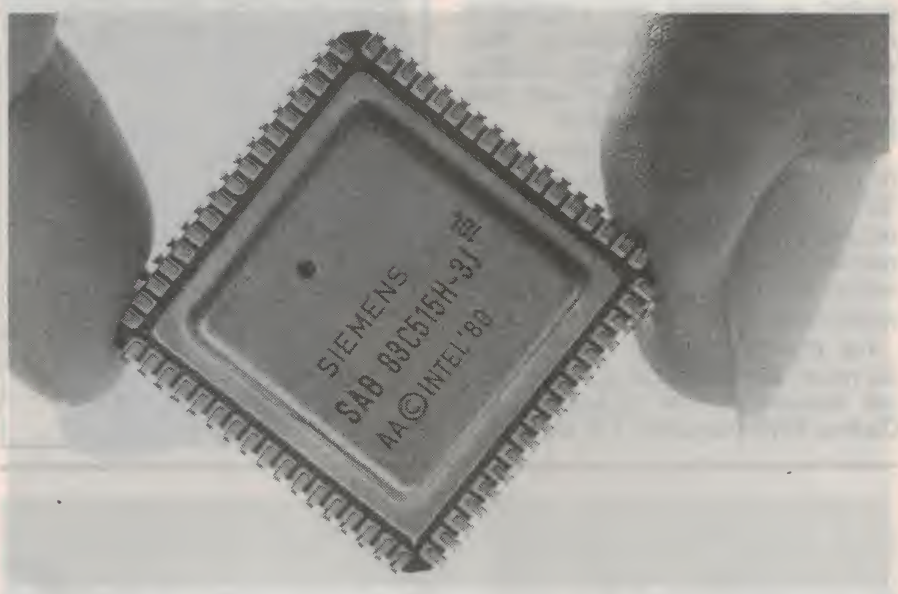
The chip contains a 765A compatible floppy disk controller with a high performance, tape drive-compatible digital data-clock separator, two VL16C450 UARTs and one parallel printer port.

Also included in this 100-lead device are an internal power management unit (PMU) to reduce system power consumption, a PLL clock circuit for one of seven CPU clock frequencies, IDE bus control signals that offer industry standard control interface with no external logic required and a single 24MHz crystal oscillator that reduces system component count.

Programmable microcontroller

Siemens is now offering the 8-bit SAB80C515 microcontroller with a programmable E^2PROM instead of a fixed-program ROM. The new SAB83C515H is fully compatible as regards functions and housing dimensions and is intended as a test and development tool for hardware and software generation. Using a mask-programmed internal ROM with microcontrollers involves considerable outlay and delays during the development phase, and these can be avoided by using a programmable chip. The SAB83C515H is a hybrid device with a 68-pin ceramic housing accommodating an 80C515 core, with its internal address and data lines connected to an E^2PROM module integrated into the same housing. The chip as a whole is fully compatible with the standard version in that it includes elements such as a 256-byte data RAM, three 16-bit timers with four high speed signal outputs, an 8-bit A/D converter with programmable reference voltages and 56 I/O lines.

For further information circle 275 on the reader service coupon or contact Siemens Components, 544 Church Street, Richmond 3121; phone (03) 420 7314.



Sealed battery charger IC

The UC2906/UC3906 series of battery charger controllers contains all of the necessary circuitry to optimally control the charge and hold cycle for sealed lead-acid batteries.

The integrated circuits monitor and control both the output voltage and current of the charger through three separate charge states: a high current bulk-charge state, a controlled over-charge and a precision float-charge or standby state.

Optimum charging conditions are maintained over an extended temperature range with an internal reference that tracks the nominal temperature characteristics of the lead-acid cell. A typical standby supply current requirement of only 1.6mA allows these ICs to predictably monitor ambient temperatures.

Separate voltage loop and current limit amplifiers regulate the output voltage and current levels in the charger by controlling the onboard driver. The driver will supply up to 25mA of base drive to an external pass device. Voltage and current sense comparators are used to sense the battery condition and respond with logic inputs to the charge state logic.

For further information circle 274 on the reader service coupon or contact Priority Electronics, 7/23 Melrose Street, Sandringham 3191; phone (03) 521 0266. ■

NEW PRODUCTS

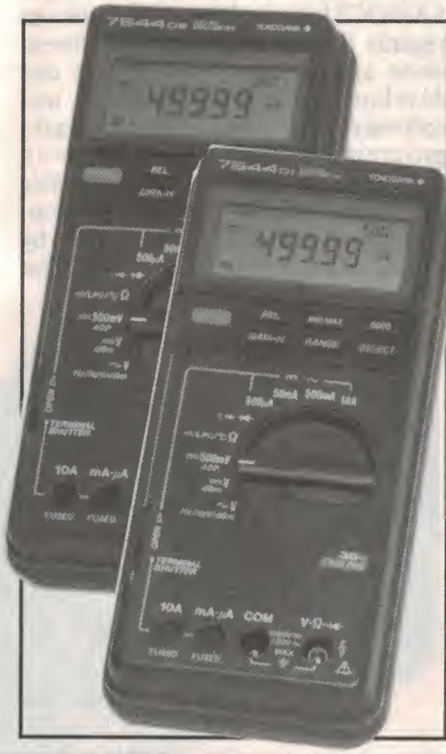
Hand-held 4.5d DMMs

Yokogawa Instruments has released two new 4.5 digit multimeters, with accuracy and safety being the main criteria.

The meters are both true RMS reading and have an extremely high count of 50,000 full scale. Apart from AC/DC volts and resistance, other features included as standard are temperature measurement, relative (variations from set value), dBm and average reading. Data hold, MIN/MAX hold and auto power off are also incorporated.

The safety aspects have been covered by manufacturing these products to IEC 348, plus having a patented shutter mechanism to stop the user being able to connect the measurement leads in the wrong sockets whilst making current measurements.

For more information circle 241 on the reader service coupon or contact Nilsen Instruments, 200 Berkeley Street, Carlton 3053; phone (03) 347 9166.



Digital voice recorder

Jacques Electronics has developed an advanced solid state digital recorder using DRAM technology.

A total message duration of up to eight minutes is available, which can be separated into four individual two minute messages if required.

The recorder incorporates both microphone and line level inputs to enable recordings to be made live, or dubbed from pre-recorded tape. Messages are protected from power failure by a 24 hour battery backup facility.

The message may be replayed indefinitely with no degradation, providing a superior system to cassette-based units.

Typical applications include: message on hold, spot announcing in PA systems and safety instructions on theme park rides.

For more information circle 243 on the reader service coupon or contact Jacques Electronics, 268 Montague Road, West End 4101; phone (07) 844 1103.

DMM kit

Computronics International has released a digital multimeter kit, the MIC7S kit supplied complete with full building instructions, component value charts, schematic diagrams and operating manual.

The kit also includes the case, all screws and hardware needed, plus test leads — providing an ideal project for schools, TAFES and colleges.

The instructions explain the theory of the circuit and the coding of components. It requires the assembly and soldering of a wide variety of electronic parts.

Once assembled, the student will have a useful instrument with all the normal features of a DMM: DC voltage from 200mV to 1000V full scale, AC voltage to 750V, resistance from 200 ohm to 20Mohm with max resolution of 0.1 ohm, DC current from 200uA to 10A, and diode check.

For more information circle 244 on the reader service coupon or contact Computronics, 31 Kensington Street, East Perth 6000; phone (09) 221 2121.

Improved 30W solder station

A new soldering station from Scope features an iron with a redesigned heater and tip system. The cartridge-type element actually fits inside the hollow tip, whereas the previous design had a hollow heater outside a solid tip. Scope claims that this internal heater concept ensures all heat must flow into the tip, with the advantage of superior heat recovering and consequently reduced tip operating termperatures.

For more information circle 242 on the reader service coupon or contact Scope Laboratories, PO Box 63, Niddrie 3042; phone (03) 338 1566.

Portable DC Calibrator for Precision Source and Measurement Functions

- ✔ Provides Vdc, mAdc and thermocouple emfs (type K, E, J, T and R)
- ✔ Compact NiCad powered with EL back lighting and weighs only 1.2kg
- ✔ Auto-stepping output function for repeated adjustments and calibration procedures
- ✔ Output division function from 1 to 15 for checking linearity
- ✔ 20 output-values storage memory
- ✔ Direct thermometer calibration
- ✔ Outputs from ±100mV to ±36V, 0 to +24mA
- ✔ Max resolution of 10μV, 10μA
- ✔ High accuracy – ±(0.5% of rdg + 0.06% of range)

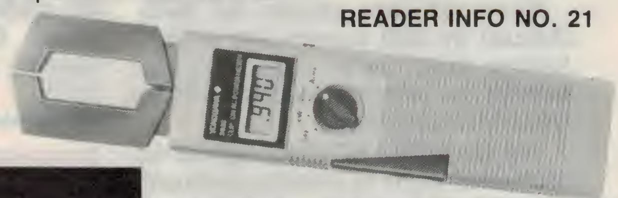
Hybrid Panel Meters Combine Analog and Digital Functions with Excellent Readability

- ✔ Colour liquid crystal displays - green, yellow, blue and red
- ✔ Analog bargraph in 90° quadrant format with 31 segments – length of segments emphasises analog change rate. Analog scale indicates % of full scale
- ✔ Digital read-out uses 3 1/2 digit format
- ✔ Cold cathode fluorescent back lighting provides clear bright colours with minimal heat output
- ✔ Models for AC and DC voltage or current. Scaling option for direct readout of values
- ✔ Analog 0-1mA or 4-20mA output option
- ✔ Over-range, decimal point and unit indication
- ✔ 92mm square cut out

Model 2433 Tong Tester Measures True RMS

- ✔ Measures voltage to 600Vrms, Current to 200Arms, Power to 200kW
- ✔ Suitable for single phase or balanced 3-phase
- ✔ Jaws accept conductors or bars up to 25mm diameter/wide
- ✔ Analog output
- ✔ Autoranging
- ✔ Ideal for noisy waveforms

READER INFO NO. 21



Model 2447 Probe Type Multimeter

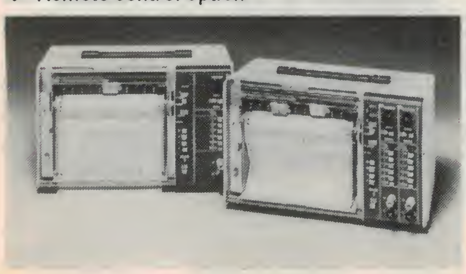
- ✔ Measures ac and dc voltage, ohms and continuity
- ✔ 3 1/2 digit 5mm high LCD display
- ✔ Data hold function
- ✔ Measures to 500V, 2MΩ max
- ✔ Convenient pocket size
- ✔ Continuity buzzer

Insulation Tester Range Suits Every Requirement – Digital or Analog, Hand-Held or Portable

- ✔ Analog battery and hand driven, digital battery driven
- ✔ AC voltage measurement ranges
- ✔ Constant voltage types
- ✔ Ranges to 5000MΩ
- ✔ Automatic hold function
- ✔ Seven different basic models

Model 3057 Portable Recorders for Field or Laboratory Use

- ✔ Compact and exceptionally reliable
- ✔ 150mm chart width
- ✔ One or two pens
- ✔ Z-fold or roll chart
- ✔ Vertical or flat bed
- ✔ AC, DC or Internal battery operation
- ✔ 12 calibrated ranges from 10mV to 50V full scale
- ✔ 60cm/min to 2cm/hr crystal controlled chart speeds
- ✔ 300mm/s max response
- ✔ Remote control option



Pocket Sized Digital Thermometers

- ✔ Semiconductor or thermocouple types
- ✔ Choice of probes (standard screw terminal connector)
- ✔ ±0.5°C accuracy, 0.1°C resolution
- ✔ Ranges from -50 to 99.9°C (semiconductor) or -50 to +600°C (thermocouple)
- ✔ Built-in time display

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North Ryde
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S. Australia	Trio Electrix	(08) 212 6235
W. Australia	Leda Electronics	(09) 361 7821
Tasmania	Meacon Systems	(002) 44 7575
Auckland N. Z.	N.E.I.	(AKL) 64 2732
Specialist Reps	Tech Fast	(02) 988 3865
	A.T.E.	(03) 543 8041

Piezoelectric traffic sensors

INTAQ International has launched a range of low cost, low profile piezoelectric polymer sensors specifically for the collection of road traffic data.

The Roadtrax Series R is designed for temporary installation — it adheres directly onto the top of the roadway surface and is able to be removed and re-used.

The sensors can perform the following tasks: counting, classifying, weighing (in motion), parking area control, toll booth systems, double wheel axle detecting, speed measurement and lane designation.

For more information circle 246 on the reader service coupon or contact INTAQ International, 27 Macquarie Place, Sydney 2000; phone (02) 252 4055.

Short circuit locator

Short and open circuits are easily detected by ATE systems, but actually locating them can be onerous — particularly on complex multi-layer PCBs with SMD components.

The ElectroTest MT150 simplifies the location of shorts by scanning the board. When its test leads are connected across the short and a weak signal is passed through it, a magnetic field is produced.

A set of coils in the scanner detects the current flow, and an image of the signal flow in the short is displayed by the MT150.

Following this signal flow on the display will lead you directly to the short circuit.

For more information circle 249 on the reader service coupon or contact Elmeasco Instruments, PO Box 30, Concord 2137; phone (02) 736 2888.

Thank God for the Salvos.

THE SALVATION ARMY

Red Shield Appeal

Microwave level gauge

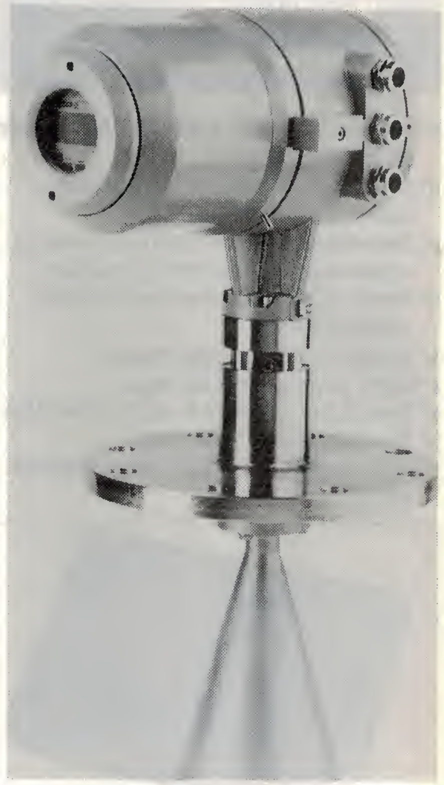
A level gauge based on microwave technology has been designed by Krohne to handle difficult applications where conventional ultrasonic or other gauges fail to perform.

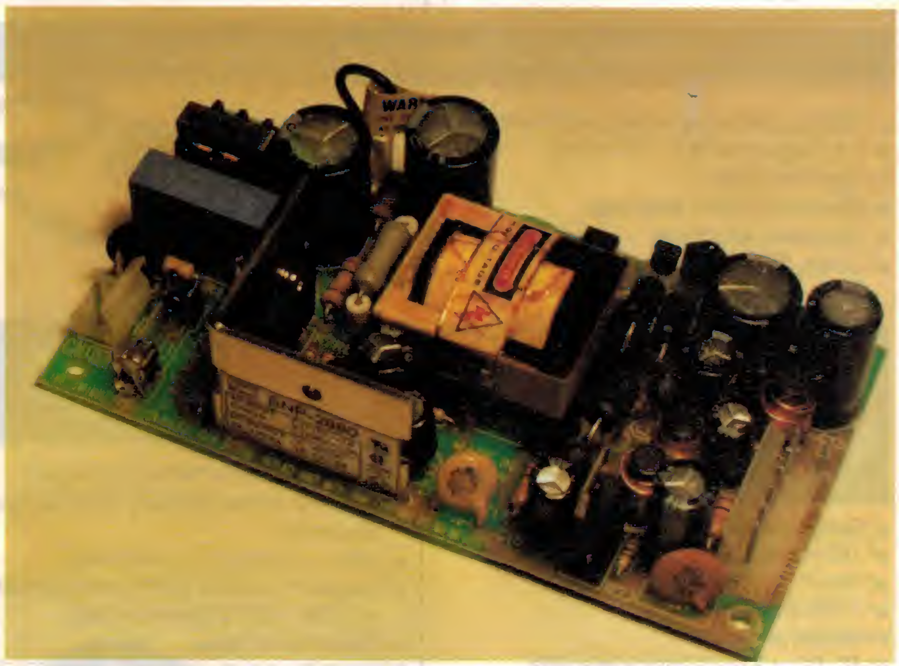
Using electromagnetic radiation, the BM70 Level Radar gauge is designed for continuous and non-contact level measurement of liquids, pastes and slurries in closed metal process and storage tanks.

Exact measurements can still be taken even if the processing tank has several agitators and a turbulent surface, or if the tank atmosphere contains smoke, dust or dry fumes. It offers individual adjustment of microwave aperture area position to the mounting flange.

The gauge will operate from a vacuum up to pressures of 2.5MPa, at temperatures from -25°C to 150°C.

For more information, circle 247 on the reader services coupon or contact Bailey Controls, 26 Auburn Road, Regents Park 2143; phone (02) 645 3322.





Approved 30W SMPS

Dewar has released its latest range of Skynet 30W switch mode power supplies. Voltages vary from 5-24V and are available in three, two, and single rail versions.

The SNP-288 series SMPS are type approved to the latest international safety standards — IEC950, ULI950, CSA950 and EN60950. The 30W flyback free running switching power supplies have overvoltage crowbar protection on output No.1 and power foldback protection on all outputs.

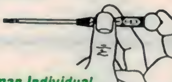
Typical applications are terminals, industrial control, external floppy systems and external hard disk drives. With dimensions of 130 x 70 x 30mm, the SNP-288 sells for $50.18 in OEM quantities.

For more information circle 245 on the reader service coupon or contact Dewar Electronics, 32 Taylors Road, Croydon 3136; phone (03) 725 3333. ■

WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR C

TOOL BOX

If you want to do a good job, use the right tools! This month we're featuring our extensive range of tools for professionals and hobbyists alike. Call in and check out your requirements. We're bound to have what you want. Take screwdrivers for example –



C K German Individual Screwdrivers
Super-slim with burnished anti-chrome peeling tips. Ball end with guiding point. Full control for tightening and loosening small screws.

Flat	2.5x60mm	$5.95
	2.5x75mm	$6.60
	3.0x100mm	$6.60
	3.0x150mm	$6.60
	4.0x100mm	$6.60
Philips	PH 0x60mm	$11.50
	PH 1x80mm	$11.20

C K German Watchmakers 6 Screwdriver Set
Flat 0.75mm, 1.4mm, 2.0mm, 2.4mm
Philips PH 00, PH 0 $18.50

C K German Extra Long
255mm Philips Screwdriver PH 1 $8.25

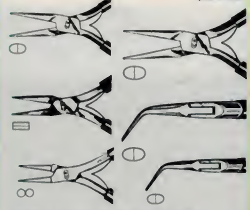
C K German Precision Screwdriver Set
As above. Contains the handy sizes
Flat 1.5x60mm, 2.5x75mm, 3.0x100mm
Philips PH 0x60mm $23.50

WITTE Power Drill Screwdriver sets
Use these with any electronic (speed controlled) power drill.
30591 Universal Holder With Magnet and 7 bits
Pozidriv PD 1, PD 2
Philips PH 1, PH 2
Flat 4x0.5mm, 5.5x0.8mm, 6.5x1.2mm $20.25
30587 Universal Holder With Magnet $11.25
30594 Pozidriv Bit Pair PD 1 $3.75
30595 Pozidriv Bit Pair PD 2 $3.75
30598 Philips Bit Pair PD 1 $3.75
30602 Flat Bit Pair 4.0x0.5mm $4.75
30604 Flat Bit Pair 5.5x0.8mm $4.75
30610 Double Ended Set contains PH 1 Philips and 4.5mm Flat, PH 2 Philips and 5.5mm Flat, PH 2 Philips and 6.0mm Flat $7.75
30613 TORX Bit T 10 $4.75
30614 TORX Bit T 15 $4.75
30615 TORX Bit T 20 $4.75

WITTE TRIAX Insulated Screwdriver Set
High Voltage insulated (1000V) right down to tip. VDE approved for safety. Contains
Flat 0.4x2.5x75mm, 0.8x4.0 x100mm, 1.0x5.5x125mm, 1.2x6.5 x150mm
Philips PH 1x80mm, PH 2x 100mm
Mains Test Screwdriver $49.50

WITTE MICRON Chrome-Vanadium Screwdriver Set
Precision technicians set. Contains
Flat 0.4x2.5x75mm, 0.5x3.0 x75mm, 0.5x3.0x150mm, 0.6x3.5 x100mm, 0.6x3.5x150mm
Philips PH 0x60mm, PH 1x 80mm $32.95

C.K. Precision Tools
Made in West Germany specifically for the electronics industry with hand mirror polish. Box joints with double leaf springs. Induction hardened cutting edges. Ceka have built their reputation since 1790! *If you want the best... there's nothing finer.*
3754 Economy wire stripping pliers for reptitive work. Adjust to strip insulation only. Brass screw and locknut, coil spring. Insulated, slip guard handles. Polished head $28.90



3767 120mm Snipenose, bent pliers $38.50
3769 150mm Snipenose bent pliers $33.10
3783 145mm Needlenose pliers $40.50
3770 120mm Flatnose pliers $37.00
3771 120mm Roundnose pliers $29.50
3772 120mm Snipenose pliers $39.95
3773 115mm best seller standard angled side cutters $42.50
3775 135mm heavy duty angled side cutters $44.60
3776 130mm standard top cutter $44.60
3776F 115mm standard top cutter $35.75
3777 150mm Snipenose pliers $39.50
3780F 110mm Mini small dimensioned, angled side cutters $40.20
3786F 120mm mini-oblique cutters $46.85
3798 120mm standard oblique cutters, short head $50.60
3799 29° angled head flush cutters 110mm ideal for tight spaces $46.25
3841 Short side cutters for hobbyists $15.40

C. K. 124P Needle File Set
Contains 6 files - square flat, pointed flat, square, round, half round, triangle. Second cur, chrome vanadium steel. Highest quality $33.00

C. K. 2302 Tweezers
Hand finished, balanced and sensitive with black PVC coating to tips $7.35

ARISTA ES-1 Electricians Neon Test Screwdriver
AC/DC tester 110V to 380Vmax. Checks live power points $2.45

ARISTA HT-28 Stubby Ratchet Screwdriver Set
3 position ratchet grip handle. Very compact. With 6 bits
Flat 0.6x4.5mm, 1.0x6.0mm
Philips PH 1, PH 2
Pozidriv PD 1, PD 2
Also accepts Witte tips $10.95

ARISTA HT-7 6 Piece Screwdriver Set
Contains Flat 1.4mm, 2.0mm, 2.4mm, 2.9mm.
Philips PH 0, PH 1 $5.95

HT-8 4 Piece Philips Screwdriver Set
Contains PH 00, PH 0, PH 1, PH 2 $5.95

HT-17 Watch makers Driver Set
Contains 16 separate tools for the handyman
Philips PH 1-1, PH 1-2, PH 0, PH 0-2
Hex Key 1.5mm, 2mm, 2.5mm
Nutdrivers 3mm, 4mm, 5mm
Flat 1mm, 1.4mm, 2mm, 2.4mm, 3mm, 3.8mm $19.95

ARISTA HT-11 Precision Tool Set
20 piece set with flat, Philips, nut and hex drivers, wrench and awl in pocket case. Contains –
Open Wrenches 4mm, 4.5mm, 5mm, 5.5mm, 6mm
Philips PH 0, PH 1.2
Nut Drivers 3mm, 3.5mm, 4mm, 4.5mm, 5mm
Four Hex Keys 1.5mm, 2mm, 2.5mm, 3.5mm
Flat 1.5mm, 2.5mm, 3.5mm
Awl, Locking Handle $10.95

ARISTA HT-6 Allen Key Set
1.5mm, 2mm, 2.5mm, 3mm, 4mm, 5mm, 5.5mm and 6mm Allen Keys on key ring $4.95

ARISTA Hobbyist Tools
HT-12 Miniature Diagonal Cutters $10.95
HT-13 Miniature End Cutters $5.95
HT-14 Miniature Diagonal Cutters $9.95
HT-15 Miniature Long Nose Pliers $9.95
HT-16 Miniature Cutters $5.95
HT-27 Magnetic Finger & Tweezer Set $11.95
CS-200 Single Operation Cable Stripper/Cutter $13.95
HT-25 Scribing tool with tungsten tip $2.95

Addison Drill Set
Rolling forged high speed steel to BS328-1959. 11 piece covers 1mm to 6mm. In sturdy steel stand-up case. $14.50

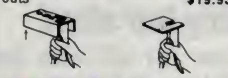
Boker Twist-N-Pick Drill Set
Contains 13 drills 1.5 to 6.5mm in 0.5mm steps plus 3.3 and 4.2mm. Convenient drum selector case. $24.80

Coax Stripper
Suits RG58 and RG59 $41.95

Coax Crimper
Suits RG58 and RG59 $88.95

D-Sub Crimper
Assemble contacts quickly $88.95

Nibbling Tool
Cuts up to 18gauge steel and other hardened metals. Ideal for copper, plastic, aluminium etc. Simply drill 3/8" hole ideal for square panel cut outs $19.95



Hole Punch Set
10 piece screw type. Holes from 16mm to 30mm diameter. Includes tapered reamer and rigid plastic carry case. $69.95

OKI Wire Wrap Tool
Finest quality $19.50
We also stock wrap wire

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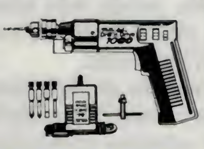

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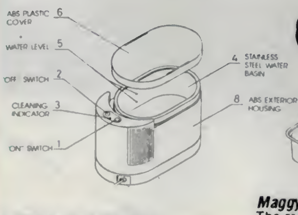

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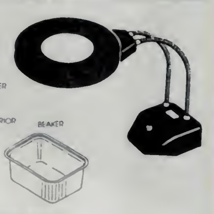

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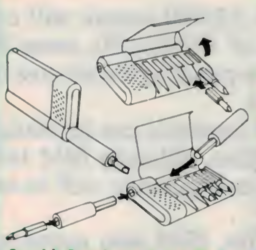

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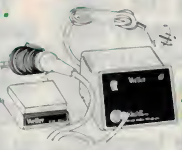

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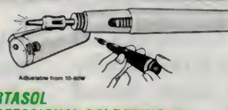

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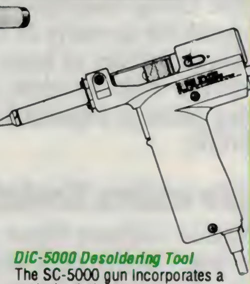

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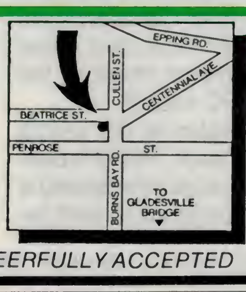

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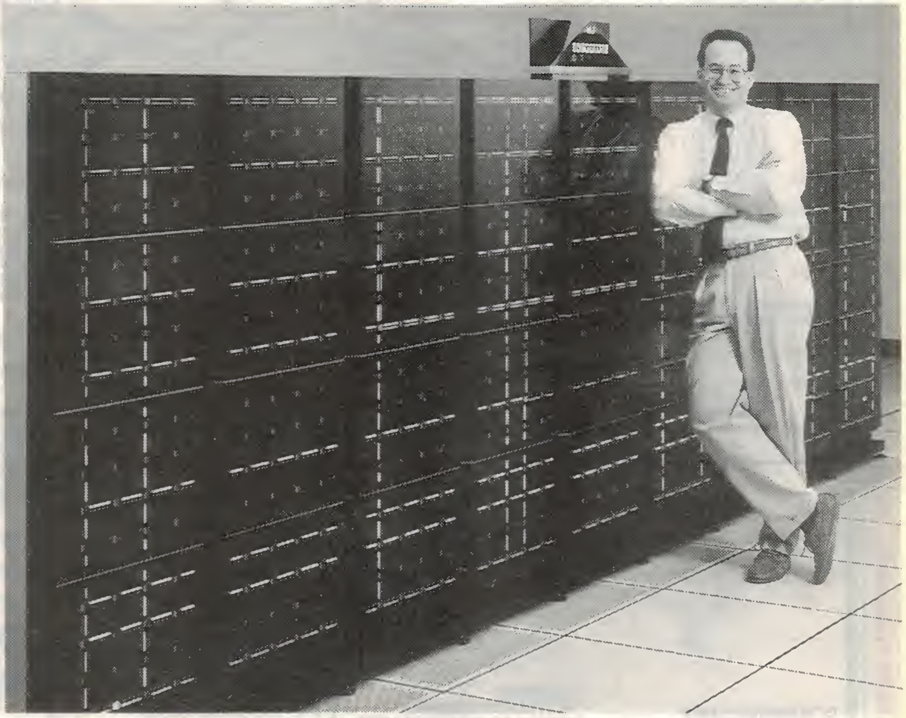
Silicon Valley NEWSLETTER



The rather confident gentleman in this picture is Justin Rattner, Director of Technology for Intel's Superconductor Systems Division, and the unassuming monolith he's leaning against is the firm's new Touchstone Delta Supercomputer. Recently unveiled at the California Institute of Technology, the machine boasts computerdom's current speed record: a whopping 8.6GIPS.

Motorola phone is candy bar sized

How far off can the age of the wristphone be? Motorola is ready to sell what it calls the smallest and lightest cellular phone on the market. The 'Microtac Lite Digital Personal Communicator Telephone' weighs just 7.7 ounces and measures 11.6 cubic inches — or a bit larger than a Mars candy bar.

If the current trend in size and weight reduction continues, and there is no reason to doubt it won't, the wristphone could become a reality by the mid 1990's.

The Microtac is an ungraded version of the original Microtac pocket phone system, which was introduced in 1989. That phone weighed nearly 40% more, or 10.7 ounches.

Motorola manufactures nearly all of the key parts in a cellular telephone and even supplies competitors with the circuits. The company hopes to maintain its image as the quality manufacturer in a turbulent and innovative field, where a new product and deep discounting are the rule.

The phone's weight and size are important marketing considerations because, longer-life batteries add several ounces. Using standard batteries, a user can speak for as many as 45 minutes on the Microtac Lite, or keep it on standby to receive calls for eight hours. Initial selling price is expected to be around US$1000.

Apple enters Soviet market

Moscow citizens know all about the 'Big Mac' McDonalds hamburger, for which they are willing to wait in long lines. But soon they will also be able to purchase 'the other Mac' — the personal computer from Apple.

Apple has announced an agreement with Intermicro of Moscow to set up a network of Apple dealerships throughout the Soviet Union, in a major push to grab a significant share of the fast growing Soviet PC market.

To date, Apple's sales to the Soviet Union have been minimal. While broadly admired, the Macintosh represented a luxury few Soviet companies and institutions could afford. But the new family of low cost Macs, particularly the Mac Classic, has competed effectively with low end PC clones in the West and now Apple is determined to become a major player in the potentially lucrative Soviet market as well.

Under the terms of the deal, Intermicro will set up and operate a network of Apple dealerships throughout the Soviet Union. To enhance sales, Apple has developed a Russian-language version of its operating system which was expected to be ready for shipment in October.

IBM launches 1GB 3.5" hard disk

IBM has launched a new low cost version of its AS/400 minicomputer family, and also announced a major breakthrough in disk drive technology.

The new AS/400 system will carry a base price of US$12,000, some $4000 less than the previous lowest cost model in the series.

Up to 14 terminals can be hooked up to the machine, although IBM believes the typical configuration will be around six users.

Meanwhile, IBM also announced it has begun shipping the first 3.5" 1-gigabyte disk drives built around a new so-called 'magnetoresistive' recording head, a read/write head that measures less than half the size of a grain of rice, and about 1/10 the size of the previous smallest recording head. The head sits at the end of a so-called 'nano-slider,' which is just 1/6th the size of a conventional slider.

The revolutionary head allows IBM to vastly increase the amount of data it can store on a conventional disk. IBM said the new head allows it to store 132M

bits of data per square inch of disk space, a 25% improvement over the old industry record of 105Mb.

That however, is only the beginning. Using new disk technologies, analysts believe IBM and others will be able to increase the storage density to several billion bits per square inch.

The new IBM drives will retail for about US$1500.

Cirrus buys Crystal

Cirrus Logic, a San Jose-based logic chip maker, has acquired Crystal Semiconductor of Austin, Texas for US$57 million. Cirrus, which has been growing steadily into a US$142 million company since its founding six years ago, will pay for Crystal by issuing nearly 3 million shares of new stock. Crystal makes controller chips and sold about US$20 million worth of the product in 1990. The acquisition will nearly double Cirrus's share of the controller market.

Cirrus chairman Michael Hackworth said the deal will give Cirrus access to a vital complementary controller technology. "I am not going to be so self-righteous as to say Cirrus has all it needs and it can go at it alone. We need some kind of partnering in order to grow."

Hackworth said he wants the name Cirrus to become just as synonymous with the controller market as Intel is associated with microprocessors. Already, Cirrus dominates the market for disk drive controllers.

While Cirrus has specialised in the all-digital circuits, Crystal has become a leader in the 'black art' of analog chip design. Its expertise will help Cirrus combine digital and analog functions onto a single mixed signal controller chip.

AMD files US$2 suit against Intel

Advanced Micro Devices has filed a whopping US$2 billion antitrust lawsuit against crosstown rival Intel, for allegedly using monopolistic anti-competitive tactics to deprive AMD of customers. If AMD wins, the damages will automatically be tripled under US anti-trust law.

The suit was dismissed as "totally ridiculous" by Intel Chief Andrew Grove, who said AMD has become the 'Milli Vanilli' of semiconductors — referring to the pop music group that was caught lip-synching during live performances. "Their last original idea was to copy Intel. Since they can't win in the marketplace, they try to defeat us in the courts and in the press."

The AMD suit was short on details. AMD spokesman John Greenagel said specific evidence of Intel's antitrust practices would be revealed at trial.

Dan Hatcheson, president of VLSI Research in San Jose, said Intel's criticism of the AMD legal move is ironic. "This is the pot calling the kettle black. Intel has been doing the same thing for years."

In essence the AMD suit seems to be a rehash of the four year arbitration case over Intel's 1987 decision to cancel a 10 year technology pact with AMD. That decision followed Intel's refusal to allow AMD the right to make the Intel 80386 processor.

The case was decided in AMD's favour and arbitrator Barton Phelps, in a lengthy decision, criticised Intel for unethical business practices towards AMD.

Snap!

The marriage of IBM and Apple has been characterised as the joining of the two most unlikely bedfellows in corporate history. A recent event showed just how far the two cultures are apart.

A team of Apple chip engineers visited their counterpart in IBM's chip design centre in Austin, to work on modifications to the RS/6000 RISC chip. The IBM folks reportedly were somewhat uneasy about having to interact with the 'off-beat' Apple gang.

The IBM engineers, figuring that the Apple colleagues are more comfortable in blue jeans, tennis shoes and sports shirts, arrived at the meeting dressed just that way.

To the shock of the Apple group, which had made a great effort to try to accommodate the corporate style of their host by dressing up in very formal three-piece suits!

They all had a laugh. " We knew then that we could work together after that", said one senior IBM manager.

New PC transmits, receives by radio

IBM has announced a portable personal computer that can communicate with larger computers via two-way radio or cellular telephone hookups.

IBM said the so-called PCradio is a notebook-sized machine, and will be aimed at service technicians, sales people, police and other mobile workers. It will give them access to data from larger computers while on road, and allow them to send to such computers.

IBM said it will offer three versions of PCradio, pending approval from the Federal Communications Commission. One version will connect with standard cellular-phone systems. Another will use the Ardis radio network owned by IBM and Motorola. The third will connect with standard telephone lines via a built-in modem. The version designed for cellular hookups can be equipped with a telephone as well, IBM said.

All models can send and receive faxes. The computers measure 8.5 x 11" and weigh less than 6.4 pounds.

They are designed to withstand vibration, rain and extreme temperatures. All have a keyboard and adjustable LCD screen. The machines can be equipped with a built-in thermal printer that uses narrow paper rolls.

The PCradios are powered by an Intel 80386 microprocessor and use the MS-DOS operating system from Microsoft. Software is entered into the machines via removable solid-state memory cards that store the programs on EPROM memory chips.

The machines, developed at IBM's Boca Raton (Florida) personal computer centre, will be available this fall. IBM said that as yet it had not determined prices.

TI follows LSI into Japanese HDTV market

Just three weeks after LSI Logic announced a landmark agreement to make HDTV circuits for Sanyo, a second major US chip maker announced it will be getting a big piece of the expected huge Japanese market for advanced television circuits.

Texas Instruments and three Japanese semiconductor makers have reached agreement on joint development of semiconductors for HDTV's.

TI, Fujitsu, Hitachi and Sony said they will jointly design and manufacture chips for the complex HDTV video signal decoders.

The pact is likely to boost TI's sales in the Japanese market and deepen its ties with Japan's largest electronics companies. "HDTV will be a locomotive of Japan's semiconductor demand, which centres on consumer electronics," said a TI spokesman.

A Fujitsu official said the companies hope the deal, just like the LSI-Sanyo agreement, will enable them to greatly reduce the number of ICs needed in the decoders — by redesigning them and combining the functions of several chips on a single chip.

Current decoders use about 70 circuits and are the size of large desk top computers. ■

Secrets of simple DC-DC converters - 2

In part one of this series we looked at the circuit theory of power blocking oscillators, as applied to DC-DC converters. Now we can make use of this theory to establish a simplified design procedure, and also to explore the various different secondary loading techniques.

by ANDREW PIERSON

As noted in part one, the value of forward bias resistor can be chosen to allow operation over a wide range of input voltages. If we use this fact, together with the high volts/turn ratios possible with blocking oscillators, it becomes feasible to design a 'universal' primary drive circuit which will satisfy a wide range of input voltage requirements.

The basic circuit diagram is exactly as shown in Fig.1 of part one, and is reproduced here for convenience. The only additions required are the rectifier-filter network(s) associated with the secondary winding(s), and possibly a filter on the DC input line.

Unlike the conventional push-pull inverter which draws current continuously throughout its operating cycle, a blocking oscillator draws current only during the power stroke. This pulse characteristic makes it more likely to introduce ripples onto the supply line, but the use of a large reservoir capacitor across the supply rails *close to the inverter itself* will normally take care of this problem.

The core assembly used will be an FX2242 (P36), which is the only pot core assembly listed in the current Dick Smith Electronics catalog. The number of primary turns has been standardized at eight, and the feedback winding should be slightly less than one turn.

As this would be physically difficult to arrange, a complete turn is used and the value of the bypass capacitor C has been chosen to reduce the feedback by the requisite amount. 26G SWG (24 or 26G B&S) ECW (enamelled copper wire) should be used for the primary and feedback windings.

Transistor Q is a 2N3055, as these devices are robust, readily available and do the job admirably in a wide range of inverters. An alternative type is the MJE3055. Because the oscillator transistor operates as an efficient switch, its heat sinking requirements are minimal.

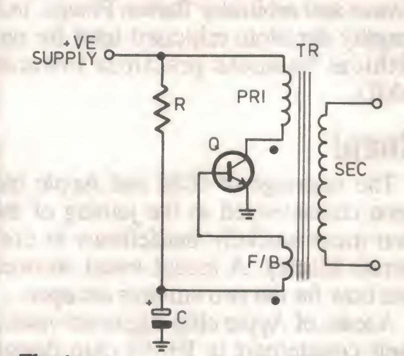


Fig.1

For low power converters, the case of the transistor itself will be adequate. At higher power levels, extra dissipation area will be required.

The optimum forward bias resistor R for operation between 5V and 20V input is 100 ohms, and its power rating is calculated as if it were connected directly across the supply rails.

The value of the bias bypass capacitor C is 10uF (when R is equal to 100 ohms). A tantalum 'TAG' type should be used, as other types of capacitors can sometimes exhibit odd inductive effects.

In practice, an inverter employing the above drive configuration will commence oscillation with a supply voltage of less than 1V, and will operate smoothly to beyond 20V.

It will allow an output power of over 5W with 5V DC input, increasing to over 25W with 20V DC input. For low output power requirements at high input voltages (up to 20V), the value of R may be increased to maintain optimum efficiency. Further notes on manipulating the value of R will be given in part three.

Secondary circuits

Having established an alternating primary flux, we now come to the tricky subject of tapping this power from the secondary circuit. The most generally useful arrangement is the *capacitor-input bridge rectifier*. This configuration forces the power and induction strokes to share the same filter capacitor, thus equalizing the voltage and power in each stroke. The secondary waveform will therefore be symmetrical and the DC output voltage will be constant, and easily predictable over a wide range of output current. The primary waveform (as measured at the collector of the oscillator transistor) will therefore also be symmetrical, and will have a peak-to-peak amplitude of twice the DC input supply voltage.

The rectified DC output voltage can be calculated from the following formula:

$$E = (V.Ns/Np) - 1.4$$

where E = the output DC voltage
V = the input supply voltage
Ns/Np = the secondary/primary turns ratio
1.4 = the voltage drop across the rectifier diodes

The worst output voltage regulation figure that can be expected with a bridge rectifier is a 20% variation in voltage over an output current range of 15%-100%. The output voltage obtained by applying the above formula corresponds to a point 65%(+/-10%) along the voltage regulation characteristic curve. In other words, the output voltage will vary by about +13% and -7% over the specified current range.

Note that these figures may not be maintained for very low DC input and/or output voltages, but they will provide a good starting point for determining the correct number of secondary turns.

The *voltage doubler* configuration is a technique which may be employed to obtain higher output voltages without increasing the number of secondary turns. However, its output regulation characteristics and control of waveform sym-

metry are not as effective as that of a bridge rectifier, because the voltage doubler configuration effectively places the power and induction stroke loads in series. The portion of output voltage contributed by the induction stroke will vary with output loading, thus producing poor regulation.

Fig.4 shows the relationship between the voltage multiplication factor (VMF) and output power level (arrived at by increasing the inverter input voltage whilst maintaining a constant load resistance) for both the voltage doubler and bridge rectifier configurations.

The resulting plots clearly illustrate the superiority of the bridge rectifier, especially at high power levels. Nevertheless, the voltage doubler can be useful where high voltages are needed and the power requirements are modest.

Don't confuse a low VMF with low efficiency: the energy from the induction stroke is always transferred efficiently, and converters using either the voltage doubler or the bridge rectifier configurations produce the same maximum efficiency figures — over 80%. If varying output load currents are expected when a voltage doubler is used, the inverter should be fed by a feedback-type input voltage regulator. An example of this technique will be shown in part three.

Please note the following very important caveat when using the bridge rectifier and voltage doubler configurations:

In order to maintain effective control of the induction stroke, a minimum output load current (Imin=15% of Imax) must be maintained at all times.

Therefore, the voltage regulation figures quoted in this text refer to a change in output current from Imin to Imax. If a feedback-type input voltage regulator is being used, Imin can be reduced to 5% or less, as the regulator will help to maintain control under no-load conditions.

Half wave rectification is used wherever it is required to selectively load either or both of the power and induction strokes. Selective loading of the induction stroke is discussed shortly, and independent loading of both the power and induction strokes will be covered in part three.

No matter what rectifier configuration is being used, the induction stroke must be loaded sufficiently so that the peak voltage of the pulse developed, divided by the Ns/Np turns ratio, does not exceed the V_{CER} rating of the oscillator transistor. As pointed out in part one, the results of an unloaded induction stroke can be CATASTROPHIC and EXPENSIVE. In this respect, working with a blocking oscillator inverter is akin to picking up a scorpion: watch out for the sting in its tail!

Whilst we are on the subject of secondary loading, please note that the primary circuit described is not intended to drive purely resistive loads. The secondary winding MUST be loaded with a valid rectifier configuration, together with an adequate value of storage capacitor. The concept of using a standard primary drive winding means that the available output power increases as the input voltage is raised. There are two indicators which will tell you that the maximum output power has been reached. The first *nominal* indication is a regulation figure of 20% or more, when a bridge rectifier is used.

The second and *absolute* indication can be observed by viewing the voltage waveform at the collector of the oscillator transistor. As the output load is increased, a point will be reached where the transistor cannot maintain saturation during the power stroke. **STAY WELL AWAY FROM THIS AREA.** Due to excessive damping, an overloaded converter using an oscillator transistor with a low gain may not start when power is first applied.

Secondary winding

For winding high voltage (greater than 100V) secondaries, 34G SWG (30 or 32G B&S) ECW is recommended. Due to the relatively small number of turns required, there will be no problem with fitting windings into the core specified. For low voltage, medium current secondaries the recommended winding wire is 26G SWG (24 or 26G B&S). For very low voltage, high current secondaries the wire diameter will need to be increased further. Practical details concerning the winding of transformers are given later in this article.

Overall efficiency

Power losses in blocking oscillator converters are due to the following causes:

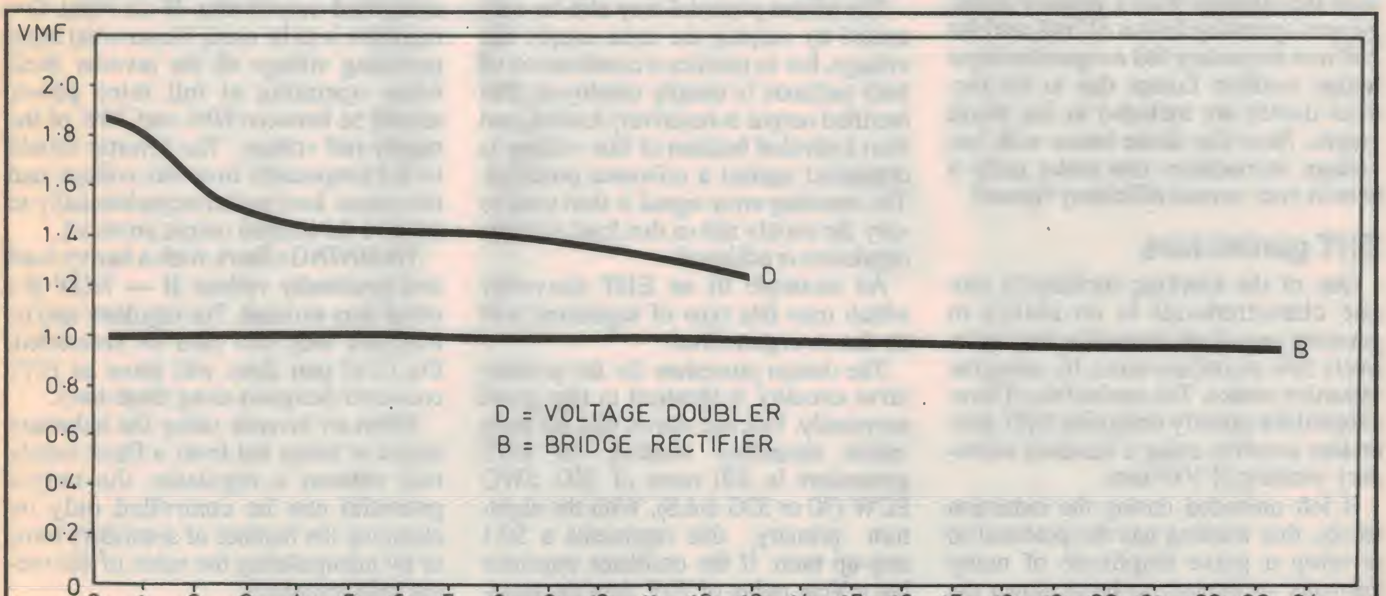


Fig.4: VMF characteristics of the converter for bridge rectifier and voltage doubler configurations.

DC-DC converters

1. DC power wasted in the forward bias resistor
2. DC power dissipated in the base-emitter junction of the oscillator transistor (supplied by the forward bias resistor)
3. Signal power dissipated in the base-emitter junction of the oscillator transistor (supplied by the feedback winding)
4. Power loss due to the voltage drop across the saturated collector-emitter junction of the oscillator transistor
5. Core losses
6. Resistive losses in the primary and secondary windings
7. Losses due to the forward voltage drop across the rectifier diodes

When all of the above factors have been reduced so far as is practically possible, the major wastage of power which remains occurs in the forward bias resistor — which, unfortunately, is a very necessary component. Because the loss in this resistor is constant, the measured overall efficiency of the converter actually *increases* with output loading.

Neglecting rectifier diode losses, the maximum conversion efficiency obtainable at I_L=Imax is about 85%, and falls to approximately 60% at I_L=0.1Imax. However, this is relatively unimportant, due to the low power levels under these conditions.

Fig.5 illustrates the variation in efficiency and output voltage against output load resistance. The test converter used the standard 8T/1T primary arrangement operating from a 5V rail, and the 200 turn secondary fed a capacitor-input bridge rectifier. Losses due to the rectifier diodes are included in the above graphs. Note that diode losses with low voltage secondaries can make quite a hole in your overall efficiency figures!

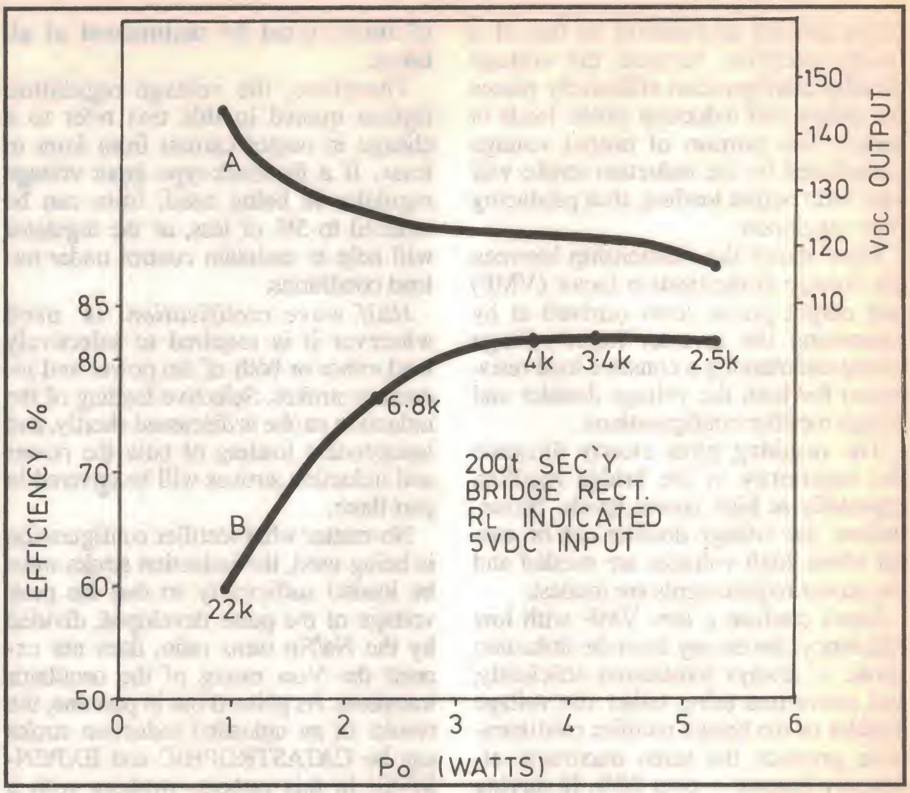


Fig.5: Regulation (plot A) and efficiency (plot B) characteristics of the converter for a bridge rectifier, with a 200 turn secondary. The values of load resistance appropriate for each output power value are indicated.

EHT generators

One of the blocking oscillator's unique characteristics is its ability to generate very high potentials from relatively few secondary turns, by using the induction stroke. The method that I have adopted for quickly designing EHT generators involves using a standard secondary winding of 400 turns.

If left unloaded during the induction stroke, this winding has the potential to develop a pulse amplitude of many kilovolts — enough to break down the transformer's secondary winding insulation, and/or destroy the rectifier diode(s), output filter capacitor or the oscillator transistor.

Since most EHT generators require a shunt load of some kind (e.g. a potential divider chain, etc.), this load can be proportioned so that the output voltage falls to the value required. If the necessary bleed current is excessive, the number of secondary turns can then be reduced.

The output potential may also be controlled by varying the input supply rail voltage, but in practice a combination of both methods is usually employed. The rectified output is resistively loaded, and then a divided fraction of this voltage is compared against a reference potential. The resulting error signal is then used to vary the supply rail so that load and line regulation is achieved.

An example of an EHT converter which uses this type of regulation will be shown in part three.

The design procedure for the primary drive circuitry is identical to that given previously. Practice shows that the most useful secondary winding for EHT generators is 400 turns of 34G SWG ECW (30 or 32G B&S). With the eight-turn primary, this represents a 50:1 step-up ratio. If the oscillator transistor has a V_{CER} rating of 70V, then the maximum voltage which the secondary can be allowed to develop is (50 x 70)V, or 3.5kV.

Whilst special EHT rectifier diodes can be used, ordinary power diodes like the 1N4007 appear to voltage share quite well, so they may be used in series to increase the total peak inverse voltage rating. For safety, a PIV derating factor of 30% to 50% per diode is recommended.

From this point, the design is best completed empirically. If an input line regulator is to be used, the nominal input operating voltage of the inverter itself when operating at full rated power should be between 60% and 70% of the supply rail voltage. The inverter should be fed temporarily from this voltage, and the output load varied experimentally to achieve the desired output potential.

WARNING: Start with a heavy load and gradually reduce it — NOT the other way around. The regulator and its feedback loop can then be connected. Fig.12 of part three will show an EHT converter designed along these lines.

When an inverter using the induction stroke is being fed from a fixed supply rail without a regulator, the output potential can be controlled only by changing the number of secondary turns or by manipulating the value of the output load resistance.

Unloaded secondaries

Some inverter applications call for a very large amplitude pulse output, but

need only a negligible amount of current. The primary configuration described here can be operated (very carefully!) with an unloaded secondary, to allow the induction stroke to develop this potential.

Because of the very low power level involved, the output pulse amplitude can be smoothly controlled by varying the value of R. This can be achieved by connecting a 5k potentiometer (wired as a rheostat) in series with the 100 ohm resistor. The usual precautions about not exceeding the V_{CER} rating of the oscillator transistor should be strictly adhered to.

Transformer winding

Although the design procedures presented here are based on the use of FX2242 or P36 potcores, other styles (e.g. 'double-U' cores) of similar dimensions should be usable. In order for the inverter to oscillate, the start of the primary winding should be connected to the collector of the drive transistor, and the finish of the feedback winding should be connected to the base (assuming that both windings are wound in the same sense).

At the commencement of the power stroke, the collector waveform is negative-going. If the secondary is wound in the same sense as the primary, the power stroke will also be negative-going and the induction stroke will be positive-going. The sense of the secondary winding is therefore chosen according to the polarity of the output pulse required.

It is necessary to have this information so that the power and induction strokes can be correctly identified. In the circuit diagrams, the starts of the windings are identified by a dot. (This assumes that the windings are all wound in the same sense).

Because of the relatively few turns required, the resulting windings will be very compact. Either single or double section formers may be used, depending on the application.

If a single section former is used, wind the primary and feedback windings first. After the application of a couple of layers of insulation, the secondary may then be wound on top.

High voltage secondaries, whether wound on top of the primary or on a separate section of the former, require special comment.

The sense of the secondary winding should be chosen so that the high voltage appears at the finish of the winding — i.e., on the outside, where it can be effectively insulated. If a high potential appears on the inside, it may break down the insulation to the core, the primary or the feedback windings.

When transformers for EHT generators are being constructed, each layer of the secondary winding should be insulated from the previous one in order to prevent inter-layer voltage breakdown.

Because these inverters operate in the audio frequency range, radiated acoustic energy due to magnetostrictive effects can be quite annoying. Several years ago when I was developing inverters of this type is a laboratory environment with others working nearby, I narrowly avoided lynching on a number of occasions!

Cores should be clean and firmly clamped together, and the transformer may be installed in a small case lined with sound absorbing material. However, the most effective method of silencing ferrite cores is to place the completed transformer in a small container (a spray-can cap is ideal), and fill the entire area with a resilient mould-making silicone rubber compound.

Part three of this series will include a description of three practical converter circuits which have been designed using the techniques previously given. Independent loading of both the power and induction strokes will be described, and practical circuit notes will be included. ■

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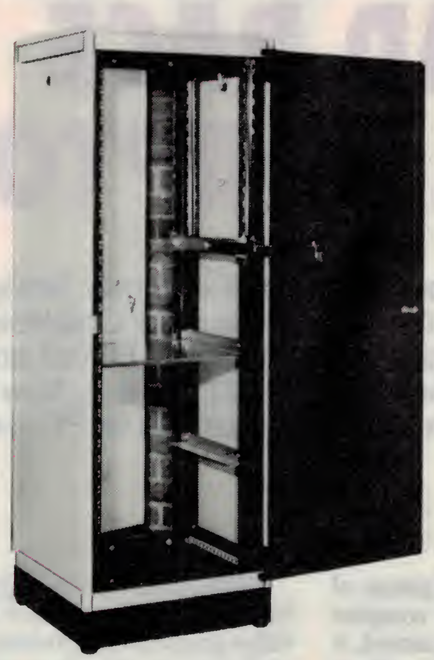

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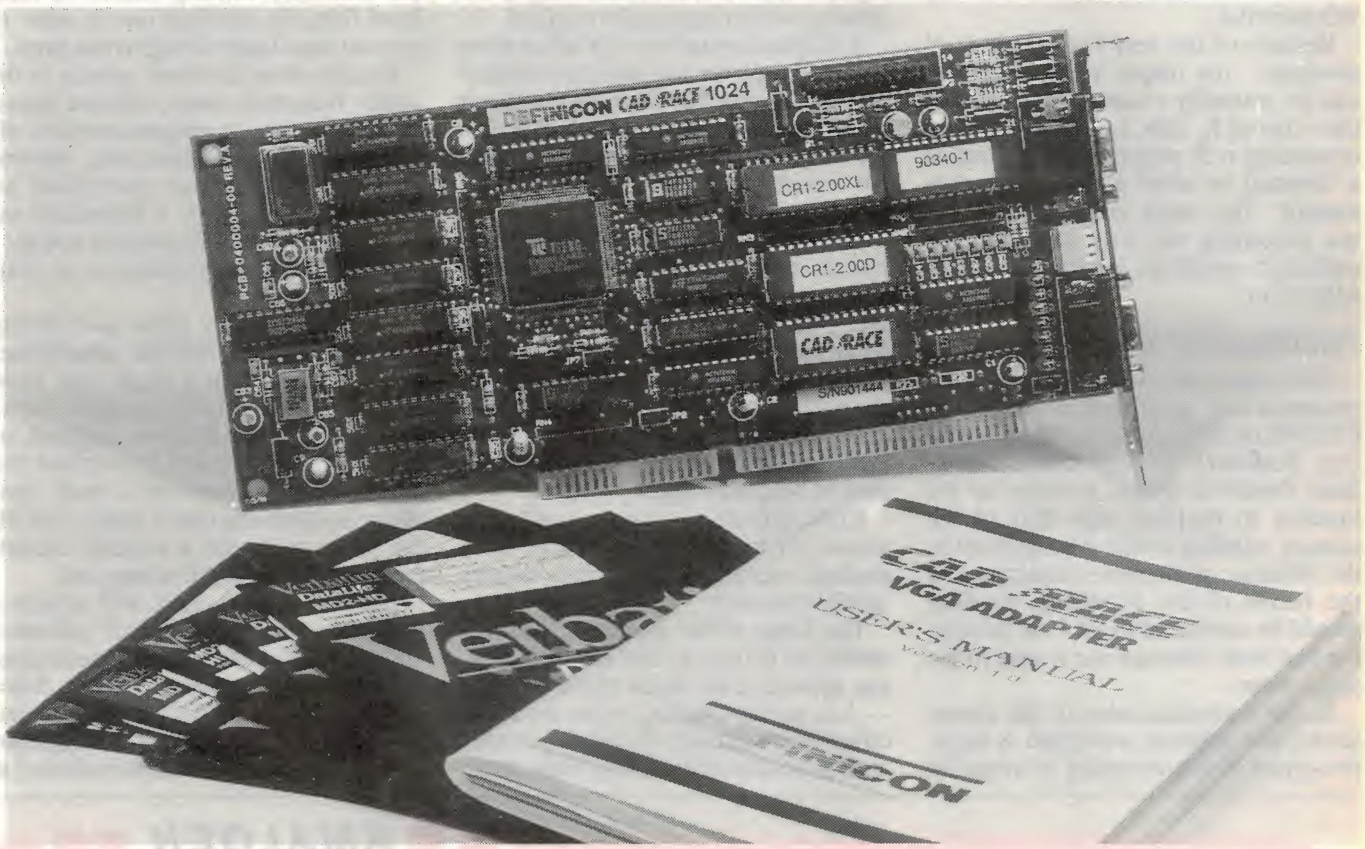


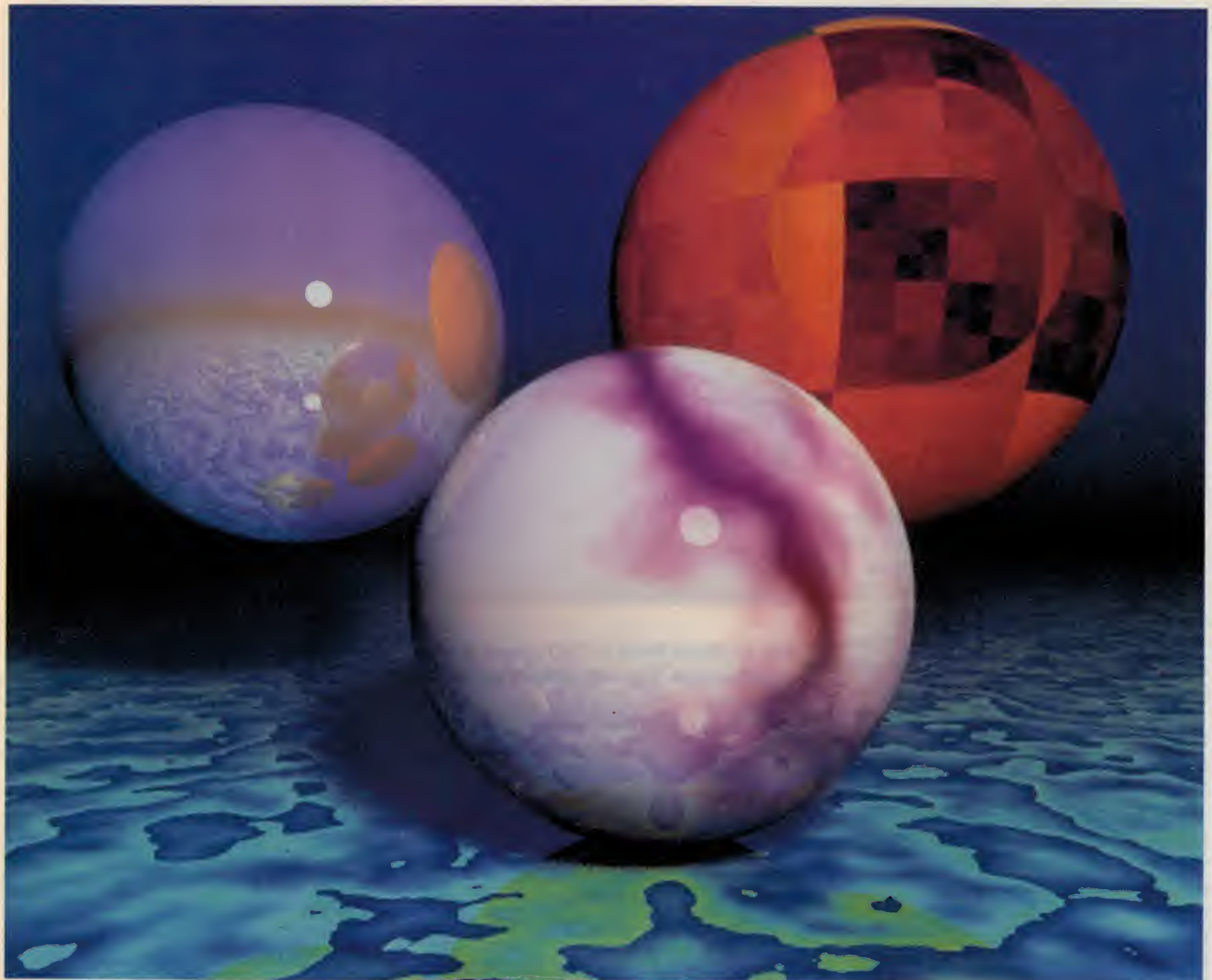
DEFINICON'S CAD RACE ENHANCED VGA ADAPTOR

You may recall that in the May 1991 issue we announced the release of a new family of video RAM-DAC chips, which incorporate the Edsun Laboratories 'Continuous Edge Graphics' or CEG-DAC system for effectively removing the scan-aliasing 'jaggies' on displayed curves and oblique lines, and also for performing colour interpolation to eliminate 'tiling' on 3D surfaces. Now Definicon has incorporated the new technology in an enhanced 'Hi-res VGA' adaptor card for PC's, and we've been able to try this out for ourselves...

by JIM ROWE

Video display adaptors have come a long way in the 10 short years since IBM first released its PC. The latest 'SVGA' or 'enhanced VGA' cards typically provide up to 1024 x 768 pixels of resolution; a choice of up to 256 colours in any one screen image, from a total palette of say 256,000 colours; and complete screen updating in a less than a second. A far cry from the original CGA, with its modest 320 x 200 pixel resolution and 16 colours!

All the same, there are a growing number of applications where this level of video graphics performance still really isn't good enough. Examples are CAD, desktop publishing, interactive computer-aided instruction, electronic



Here's an example of the kind of graphics resolution made possible by Edsun's CEG system, as used in the Definicon CAD RACE card. The sphere at upper right has the CEG disabled, to show the tiling effect produced by normal VGA graphics.

image enhancement and manipulation, and so on. Each of these tends to call for even higher video graphics resolution, the ability to display a greater range of colours, and much faster screen updating.

Of course this kind of graphics performance is already available, in the form of professional 'graphics workstations', with resolutions as high as 1200 x 1200 pixels (or more), a palette of as many as 16 million colours, and 'video engines' capable of updating the display almost instantaneously. But these generally also have a corresponding price tag — typically as high as $25,000.

The problem is that achieving higher video graphics performance isn't easy, without jacking up the cost at the same time. Higher resolution normally tends to mean higher scanning rates, and this in turn means higher video bandwidth, more costly circuitry and often the need for more memory and disk space in order to store the image files.

Similarly in order to provide a wider range of colours, we normally need to increase the *colour resolution* — i.e., we have to use more bits to specify the larger number of possible levels for the primary colours used to produce the image. This too calls for more complex and costly circuitry, as well as requiring even more memory and disk space for the image data.

It's therefore understandable that computer hardware designers have been searching for other ways to improve video graphics performance — as opposed to the sheer 'brute force' approach.

Part of this search has involved a re-examination of users' needs, and the real shortcomings of current low-cost display technology. For example what are the *real* limitations of a modern SVGA display adaptor and monitor combination, in practice?

Essentially there are still two significantly weak areas. One is that curves and oblique lines in a displayed image still tend to have an obviously 'stepped' outline — commonly known as *the jaggies* (Fig.1).

This is due to the inherent inability of the display system to provide a smooth outline, because this requires a resolution greater than the scanning resolution. In fact it is an example of *aliasing*, where the required display resolution is greater than the system's effective sampling resolution.

The other weakness is that with only 256 different colours available, the *colour resolution* of the display is generally too coarse to provide smooth

transitions from one colour to another, for realistic display of 3D graphics or pictorial images.

The human eye is very sensitive to colour variations, and can easily spot the colour changes in an image produced from only 256 different colours (Fig.2). This is generally known as *tiling*, as the image surface tends to look as if it's formed from 'tiles' of each available colour.

How then can these shortcomings be overcome, other than by the traditional remedy of higher resolution/bandwidth/cost?

Different approach

As we reported back in the May issue, one very practical approach has been developed and recently patented by Edsun Laboratories, of Waltham in Massachusetts, USA. Known as the *Continuous Edge Graphics* or 'CEG' system, it involves special dedicated hardware in the display adaptor, which is able to 'interpret' the supplied image information and add additional *interpolation* information of its own — using proprietary video information processing algorithms.

The interpolation provided by the CEG system is capable of increasing both the effective scanning resolution and colour resolution of displayed images, without any change to the basic SVGA resolution (but relying on the use of an 'analog' type video monitor, which is nowadays the standard type fitted to SVGA adaptors). Hence it tends to eliminate both the jaggies and colour tiling, achieving a very significant improvement in the perceived quality of displayed images, at relatively low cost.

Fig.3 shows in a broad sense how this is done. In A we see a short segment of an oblique line, showing the stepped formation characteristic of 'jaggy' aliasing. Compare this with B, where the CEG hardware has processed the video data and added interpolation information, turning on pixels around the 'steps' in a finely graduated way.

In this extreme close-up view, it may look as if this has degraded the resolution rather than improved it, but if you hold the page at arm's length you'll start to see that it does indeed improve the apparent resolution and provide quite significant 'smoothing'.

In the same kind of way, the CEG system virtually eliminates the colour tiling effect by monitoring colour gradations, and automatically softening them where it senses that this is appropriate. This is done by a 'dynamic colour palette' system, where the Edsun hardware algorithm can effectively draw from a palette of up to 7136 different colour shades, in each horizontal line of say 1024 pixels.

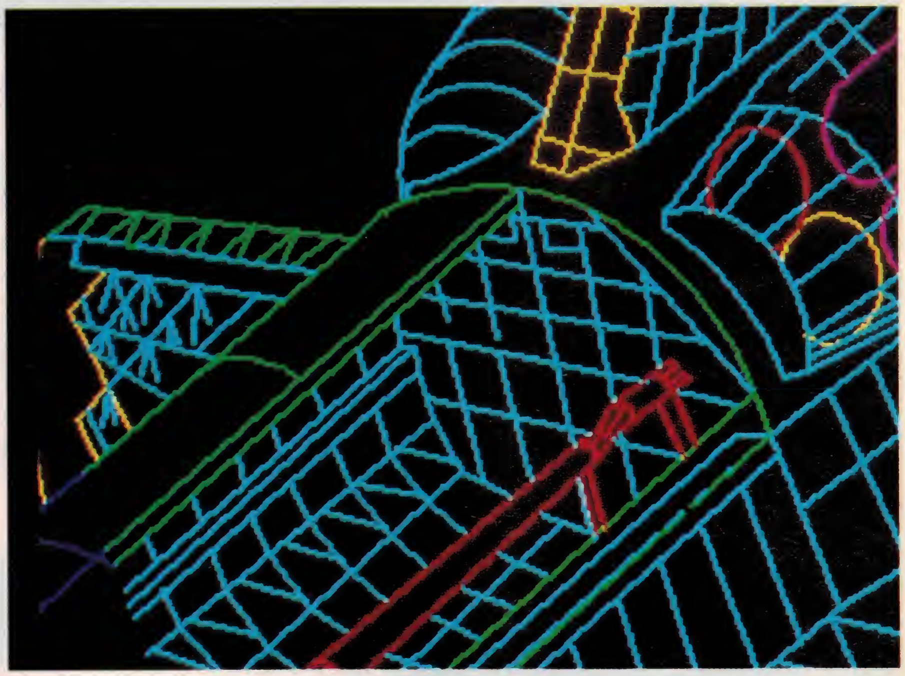


Fig.1: Detail from a CAD image displayed on a standard S-VGA video adaptor, showing the 'jaggies' produced by scan aliasing.

All of this happens automatically in the video display hardware, in real time and transparently to the user.

Sounds great, you may say — but when will we see video adaptors which incorporate the CEG system, and how well does it work in practice?

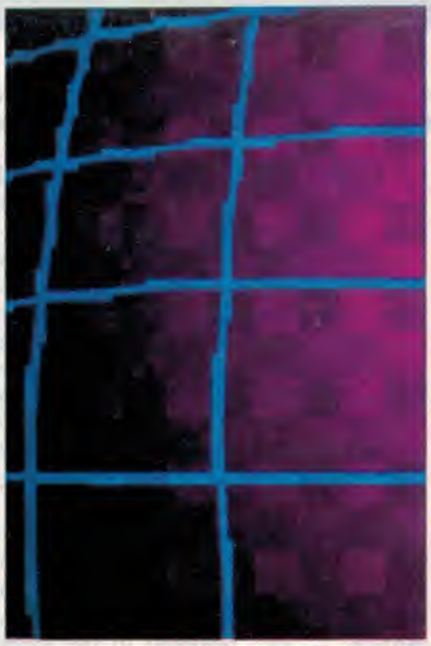


Fig.2: An example of the 'tiling' effect produced when displaying continuous tone gradations on a standard S-VGA display. 'Jaggies' are also visible here.

First CEG adaptor

The answer to the first of these questions is that an enhanced VGA adaptor featuring CEG processing has now become available in Australia.

Designed and manufactured by Californian firm Definicon International, it's called the CAD RACE adaptor, and thanks to the local distributor Reptechnic we've been able to try out a sample card along with its driver software and a set of demonstration software. So we're also able to answer the second question as well, shortly.

The CAD RACE adaptor comes as a standard-looking 'short length' card, which plugs into a 16-bit 'AT' slot in the usual way. It is fitted with both 15-pin 'analog' and 9-pin 'TTL' video output sockets, and will work with either analog or TTL monitors — but the CEG enhancement features are only realisable if you use an analog monitor, of course. For multi-mode use the monitor should also be of the multi-scan type.

The adaptor is designed for 16-bit interfacing with the main processor, and has 1MB of video RAM fitted.

It is fully bit- and register-compatible with the IBM video graphics array, and capable of emulating a standard MDA, HGC, CGA, EGA and VGA if desired, along with common SVGA display

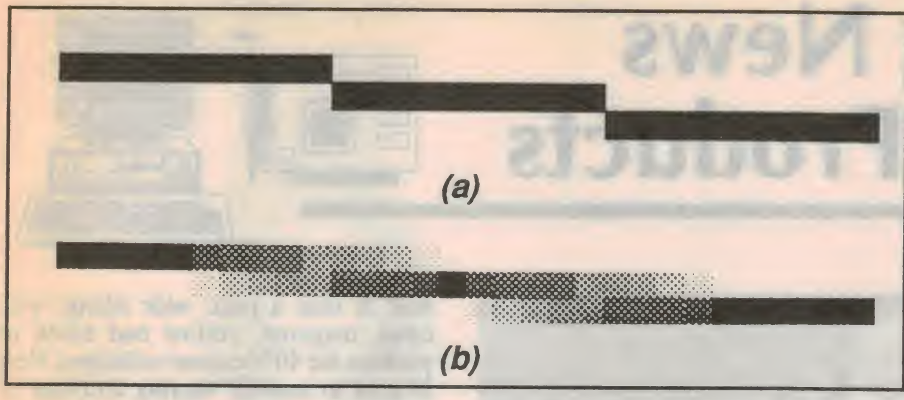


Fig.3: How the CEG system acts to smooth out 'jaggies' produced by scan aliasing. An aliased line is shown in (a), while (b) shows how the CEG hardware algorithm adds interpolation pixels of various densities and colours.

modes such as 640 x 400 (256 colours), 800 x 600 (16 colours) and 1024 x 768 (16 colours).

However it is also capable of providing 256-colour display in both 800 x 600 and 1024 x 768 pixel modes, and with the appropriate software drivers to activate the card's inbuilt CEG image processing, it can also provide enhanced-resolution display with up to 792,062 colours, for 640 x 400, 800 x 600 and 1024 x 768 pixel modes.

Along with the CAD RACE adaptor comes a comprehensive user manual, and a 1.2MB floppy disk with a set of software drivers to suit a wide range of popular system and applications packages. These include drivers for *AutoCAD*, *AutoShade*, *Windows 3.0*, *Ventura Publisher*, *GEM*, and applications using the IBM 8514/AI applications interface.

The CAD RACE manual also advises that many of the newly-released US software packages now have their own built-in high resolution drivers to allow them to take advantage of the card's CEG graphics enhancement system. Examples include Interactive Systems' *X-Windows*, *ColoRIX*, *DesignCAD 3D*, *Tempra* and *Fractools*.

The disk supplied with the adaptor also provides quite a few software utility programs, to help a user or programmer in making best use of the card. These include diagnostics, BIOS patch routines to speed up video updating, font editors and loaders, a display centering routine and a replacement for ANSI.SYS to suit the card's additional facilities.

Demo package

With the sample CAD RACE card sent for review, we also received a set of disks with a very elaborate 'demo' software package — designed to demonstrate the benefits of the CEG enhancement system. So when we had installed the card in a test system (a new 486/33MHz machine, fitted with a fast hard-disk drive and a 20" Philips 4CM2789 high-resolution monitor), we fired up the demo package and put it through its paces.

Installation of the card was very straightforward, by the way, following the instructions given in the manual.

The demo was very impressive indeed. The first part was a set of hi-res images, many of them with the CEG enhancement system switched dynamically so that the enhancement effect is present on one half of the screen, but not on the other. This made it very easy to compare the two, and see the effect of CEG interpolation on both 'jaggies' and 'tiling'.

From this part of the demo there was no doubt that the CEG system can provide a very worthwhile improvement in perceived video resolution. Curves and oblique lines were much smoother, while colour gradations on 3D surfaces, etc., had no perceptible tiling at all.

Of course as the CAD RACE adaptor's manual points out in its technical reference section, the degree of perceived display improvement depends upon the physical dimensions of the lines and edges that are smoothed by the CEG system, and the distance from the viewer's eye. So factors such as display mode/resolution, monitor size and dot pitch, and viewing distance all play a part.

We noticed ourselves that if you viewed some of the demo images from too close a distance to the 20" screen, the CEG-enhanced lines tended to take on a 'twisted rope' appearance.

But at a more normal/sensible viewing distance, or later when we tried running the demo again with a standard 14" monitor, this wasn't evident because the lines were smaller in terms of visual angle.

Definicon suggests that for a 19" or larger monitor, the benefits of CEG enhancement really can't be realised unless you're working in 1024 x 768 mode and your monitor is fitted with a tube of 0.31mm colour pitch or better.

Similarly the minimum resolution mode suggested for 17" monitors is 800 x 600, with a CRT colour pitch of 0.28mm or better. With a standard 14" monitor they suggest that the benefits are worth using even for 640 x 480 mode, providing your monitor has a colour pitch of 0.28mm or better.

The rest of the CAD RACE demo consisted of a 'slide show' of various hi-res images — from CAD systems, painting packages, photographic scanning/editing packages and so on — followed by a 'movie' of ever changing hi-res dynamic fractal images.

Here the static images were impressive enough, rivalling the images on high-quality video and CAD workstations. But the fractal movie was simply dazzling — like a sequence from Disney's classic *Fantasia*, or a view into some kind of 'super kaleidoscope' containing an enormous number of tiny multi-coloured glass shapes. The perceived graphics resolution was extremely high, while the image updating speed was so fast that you lost all awareness of watching a computer display.

Perhaps this image updating speed was helped by our use of a 33MHz 486 system to test the CAD RACE adaptor, and by the fast 13ms accessing time provided by the system's HD drive. But it's also evident that the adaptor's CEG hardware-based graphics enhancement system doesn't impose any noticeable penalty, when it comes to video updating speed.

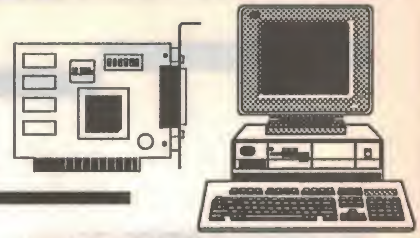
In short, then, we found the Definicon CAD RACE adaptor very impressive indeed. It certainly demonstrates the effectiveness of Edsun's CEG graphics enhancment system, delivering graphics that are considerably smoother and visually more satisfying than the standard variety for the same basic scanning resolution. And all of this while maintaining full compatibility with existing video graphics standards...

The best news, however, is that the CAD RACE card isn't all that expensive. Currently it's available for only $640, including tax — not much more than many 'plain vanilla' SVGA cards.

At present it's only available directly from Reptechnic, however, so don't try looking for it at your local computer dealer.

Reptechnic's address is 3/36 Bydown Street, Neutral Bay 2089; phone (02) 953 9844. ■

Computer News and New Products



Low cost colour printer

Siemens has brought the cost of colour page printers down to below $6000, with the launch of a Mannesmann Tally thermal transfer machine priced at $5500.

The new machine is capable of printing 4096 colour combinations, including 16 grey scales, at one page per minute, with a resolution of 300 x 300dpi.

The MT7400C will be shipped with drivers for Microsoft Windows 2.0 and 3.0. This will allow the printers to be used with the vast majority of advanced graphics and desktop publishing applications which run under Windows. In addition, other drivers already complete include AutoCAD, Lotus and Auto Route.

The printer takes out sheet paper and transparencies from the internal paper tray. It uses a page wide ribbon with cyan, magenta, yellow and black to produce the 4096 colour variations. Heat is used to transfer varying amounts of each colour, leaving a light-fast, indelible image.

The machine is supplied with 1.5MB memory as standard. Two and four megabyte upgrades are available. Both Parallel Centronics and Serial RS232 interfaces are included.

For more information, circle 166 on the reader services coupon, or contact Siemens, 544 Church Street, Richmond 3121; phone (03) 420 7111.

S-VGA includes graphics accelerator

The Fahrenheit 1280° from Orchid Technology is a new super VGA graphics accelerator that delivers a minimum speed increase of up to 25 *times* over standard super VGA. It also supports resolutions to 1280 x 1024, and as many as 32,768 colours. Refresh rates to 72Hz are supported at 1024 x 768 and lower resolutions for flicker-free operations.

The accelerator features a graphics processor that provides hardware support for commonly used functions of Windows-based applications, e.g., BitBlt, raster operations, image transfers, line drawing/clipping and colour expansion. The result is a very fast super VGA board. It ships in two configurations: 512K or 1MB VRAM. Both versions support all other super VGA modes.

For more information circle 162 on the reader service coupon or contact Pericomp Computer, 189 Kent Street, Sydney 2000; phone (02) 247 8833.

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Video frame grabber card for PCs

Mondotronic has released the MF400 video frame grabber which is fully designed, manufactured and supported in Australia.

This small, low cost system for the PC or compatibles features a resolution of 256 x 256 pixels, with 8-bits per pixel or a 256-level gray scale. Input is accepted from any standard video source such as video-camera, VCR or videodisk. Frames or fields are captured in real time of 1/50 second.

Both a line phase-locked loop and an anti-aliasing filter are incorporated for a stable, crisp display. Three video input connectors allow up to three images to be captured sequentially, and displayed simultaneously to the VGA screen in either step-by-step or continuous mode.

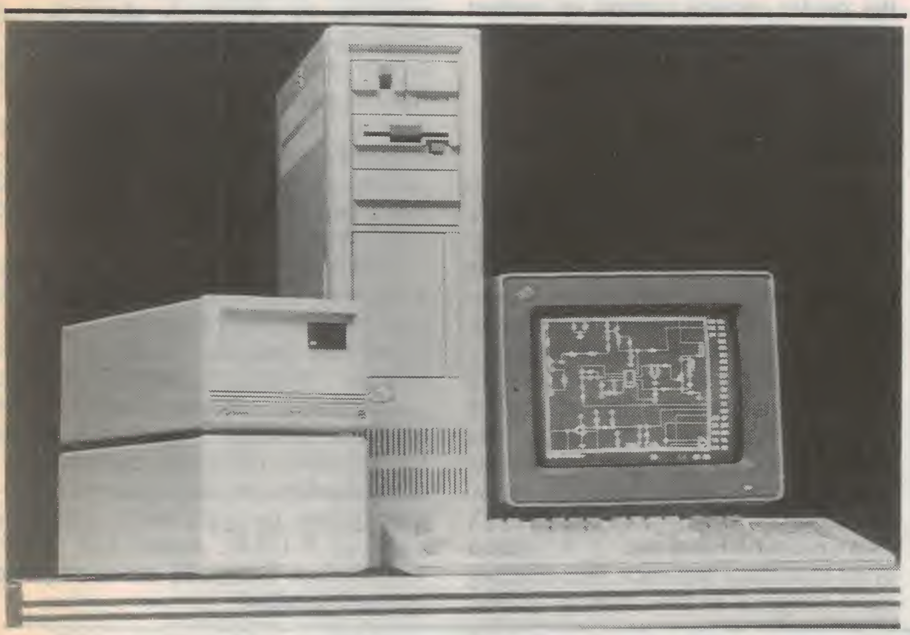
The MF400 is also equipped with on-board address switches to allow up to four cards to be operated within a PC. This enables up to 12 cameras to be scanned and simultaneously displayed on a super VGA screen with 1024 x 768 resolution. Applications range from desk-top publishing, security, student and corporate ID to personalised stationary. The price is $360 including sales tax.

For more information circle 164 on the reader service coupon or contact Mondotronic, 560 Waverley Road, Glen Waverley 3150; phone (03) 802 4110.

High capacity tape cartridges

Fuji Photo Film has introduced its new 4mm data cartage DDS DG series, with a large 1.3GB memory capacity. Even larger capacity (up to 2.5GB) is provided in the company's QG series.

Specially refined for computer applications, the DG and QG series new Superfine Metallix particles are densely packed and uniformly oriented. The design produces outputs of +1.5dB (DG) and +1.0dB (QG), compared with the



UPS systems for PCs

Astron Australia has released the Astron US386 series of uninterruptible power supply (UPS) systems, specially designed for high performance personal computers.

A key feature of the US386 system is its small size (similar to a full-height floppy drive) and its ability to handle the high peak load demand needed by 386 systems.

There are three modules in the series — US1386, US2386 and US3386.

The US1386 provides the back-up power supply, but also filters electrical 'noise' and protects the system from power spikes during normal operation.

The US2386 is similar but is designed more for areas of fluctuating voltage environments — it provides full voltage regulation even during 'mains available' mode, and the US3386, again similar but with an isolation transformer to give the voltage regulator an isolated output — ideal for PC's connected to a Local Area Network (LAN). Prices range from $740 up.

For more information circle 161 on the reader service coupon or contact Astron Australia, 2 Nicole Close, North Bayswater 3153; phone (03) 729 5611.

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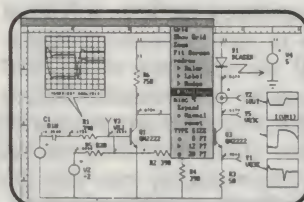

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reference tape. To reduce the spacing loss that causes errors, Fuji uses an extremely smooth base film and a supercalendering technology that creates a mirror finish on the magnetic layer surface. Also a backcoating of very low friction coefficient gives assurance of smooth transport, even with the complex transport modes and mechanisms of DDS systems.

For more information circle 168 on the reader service coupon or contact Hanimex, 108 Old Pittwater Road, Brookvale 2100; phone (02) 938 0400.

24-bit Mac colour card

Micron Technology has released the Xceed MacroColor II video card (MGXC12), for the Apple Macintosh II family of computers. This new card provides high performance, low cost 24-bit video for the Macintosh II family of computers, and is targeted at desktop publishing, paint/imaging programs and other graphics applications.

The MacroColor II card displays 'true colour' images, or up to 16.7 million simultaneous colours on many standard 13" and 14" monitors (including the Apple RGB) at a resolution of 640 x 480 pixels. It is designed for easy installation in a single NuBus expansion slot and is optimised for peak performance without acceleration. Software package with each card purchased includes a Virtual Video utility to provide desktop expansion beyond the standard 640 x 480 pixels. This utility is a valuable feature for CAD applications and programs with large graphics files, providing access and use of a larger display area than the monitor is physically capable of providing. The Xceed MacroColor II is priced at $950.

For more information circle 170 on the reader service coupon or contact Reptechnic, 3/36 Bydown Street, Neutral Bay 2089; phone (02) 953 9844.

Low cost relay card

The PC-63 is a low cost, low power relay card for any PC-XT/AT personal computer needing a control interface for control of external devices.

The card uses 16 reed relays for the 16 channels, with 16 LEDs indicating the channel status and for diagnostic purposes. The relays are arranged in two ports, with eight relays on each port and are controlled with specific bit patterns to each port on the PC data bus. The card also has a DIP switch selectable base address to avoid bus clashes. Since reed relays are used, the maximum power each channel can handle is 10W with maximum voltage rating being 150V and maximum current of 1A. The PC-63 is supplied with demonstration software for testing and showing the cards features, with full source code provided to assist programming.

For more information circle 169 on the reader service coupon or contact Boston Technology, PO Box 415, Milsons Point 2061; phone (02) 955 4765.

Video signal distribution system

Video distribution systems (VDS) for use in training room applications are now available from Thomas Electronics.

The systems transmit video signals from the trainer's screen (the master unit) to the student's screen (slave unit). Students can view the trainer's application on their screens and return to their own work station at the flick of a switch (supplied with each slave unit). The image viewed by the student is as crisp and clear as that on the trainer's screen. The ability to switch from the student's own application and that of the trainer gives immediate feedback, thus enabling rapid progress in the learning process without continual reference to the trainer. The system will drive any analog monitor, including IBM VGA, Super VGA and XGA, as well as Apple Macintosh and the Amiga. The standard system supports up to 12 users, but this can be increased to 20 users with the addition of an external power supply.

For more information circle 171 on the reader service coupon or contact Thomas Electronics, 12 Larkin Street, Riverwood 2250; phone (02) 53 0721.

'Intelligent' keyboard for PCs

VersaKey is an Australian designed and manufactured plug-in replacement for all standard personal computer keyboards. In addition to offering all standard keyboard functions, it provides an additional 60 keys by which users may dynamically record up to 30,000 keystrokes. Not macros or application sensitive programs — just boring tedious, old keystrokes. VersaKey is totally self contained and independent from the PC; it simply plugs in and plays. To attach a keystroke sequence to any of the 60 keys you simply press 'Learn', press the required key and commence typing. Once learnt, the keystroke sequence is stored in non-volatile memory and may be replayed when required by simply pressing the appropriate key.

Definition cartridges can plug into any VersaKey keyboard and effectively double the amount of memory and number of keys available. Users may toggle between VersaKey's internal memory, and keystroke sequences stores in the definition cartridge. Typical applications for VersaKey definition cartridges include standard corporate procedures, enhancements to application programs such as P-CAD, AutoCAD, SAS, WordPerfect, Lotus 123 and accounting system operation.

Australian Computers & Peripherals from JED... Call for data sheets.

The JED 386SX embeddable single board computer can run with IDE and floppy disks, or from on-board RAM and PROM disk. It has Over 80 I/O lines for control tasks as well as standard PC I/O. Drawing only 4 watts, it runs off batteries and hides in sealed boxes in dusty or hot sites.
It is priced at $999 (25 off) which includes 2 Mbytes of RAM.

$300 PC PROM Programmer.
Need to programme PROMs from your PC?
This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb.
It does it quickly without needing any plug in cards.

JED Microprocessors Pty. Ltd.
Office 7, 5/7 Chandler Rd., Boronia, Vic. 3155. Phone: (03) 762 3588 Fax: (03) 762 5499

For more information circle 173 on the reader services coupon or contact ACTek Technology, 55 City Road, Southbank 3205; phone (03) 686 1337

Dual-bin 8ppm laser

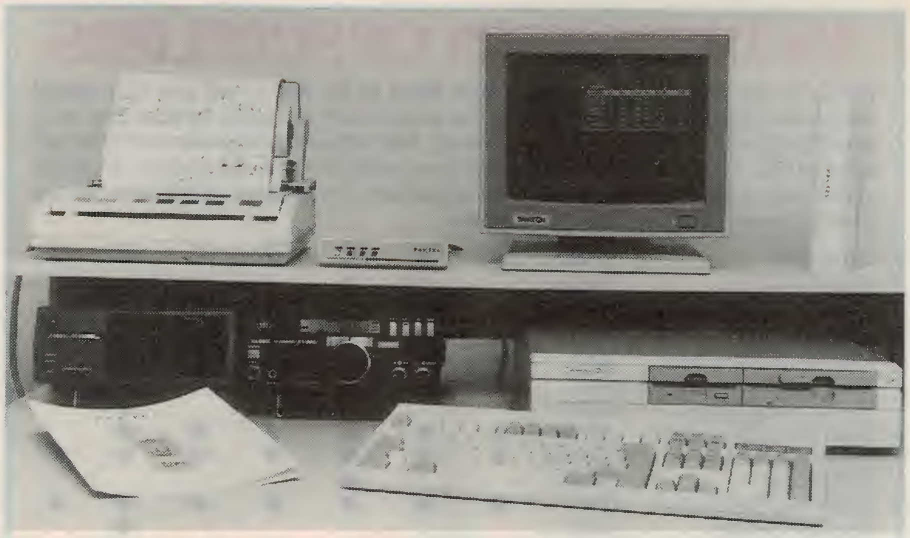
Memorex Telex has announced the 1408 Duplex, a dual bin laser printer designed to minimise paper wastage. The 1408's dual bin/duplex feature also allows users to print on both sides of a page, reducing a company's paper consumption by up to 50%.

Designed and manufactured locally, the 1408 printer is claimed to have the highest Australian content of any printer on the market — including Australian designed and developed ASIC chips, which are located on the motherboard.

Users of HP's Laserjet Series II and compatibles can choose to upgrade their printer with Memorex Telex's 1408 upgrade board, including Laserjet III features such as scalable fonts and HP plotter emulation.

The board also contains a 68020 20MHz processor, which enables it to print eight graphics-intensive pages per minute.

For more information circle 172 on the reader service coupon or contact Memorex Telex, 3 Thomas Holt Drive, North Ryde 2113; phone (02) 805 5805.



Radio fax, telex system

An Australian radio modem and very powerful PC-based software from the UK have been designed to work together to provide a very effective, error-free high frequency radio fax, data and telex communication system. The Paktel HF data communications system allows communications over long distances between remote and widely separate locations and different parts of the world. Paktel's novel 'on-the-fly' data compression and expansion, coupled with the CPU-100 radio modem's powerful error correcting features, ensure the highest data transfer rates that given radio conditions will allow. By using a simple set of menus, an operator can send different types of information via different modes, e.g., data files, special forms, morning reports, fax, computer programs and telex messages. An inbuilt 'Forms Mode' can be used for simple creation of daily reports. For more information circle 167 on the reader services coupon or contact GFS Electronics, 17 McKeon Road, Mitcham 3132; phone (03) 873 3777. ■

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MATHCAD	student	65
OPFIL	professional	1500
OPFIL	LC-1 expansion	450
OPFIL	educational	600
ICED-32	IC layout for 386, 486 †	3570
ICED-16	IC layout for XT up †	2590
THE DRC	IC design rule checker †	2590

† Available free to educational institutions under certain conditions.
All student software post free in Australia, professional versions add $30 carriage and insurance

For further information, call David on
(02) 639 3507
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Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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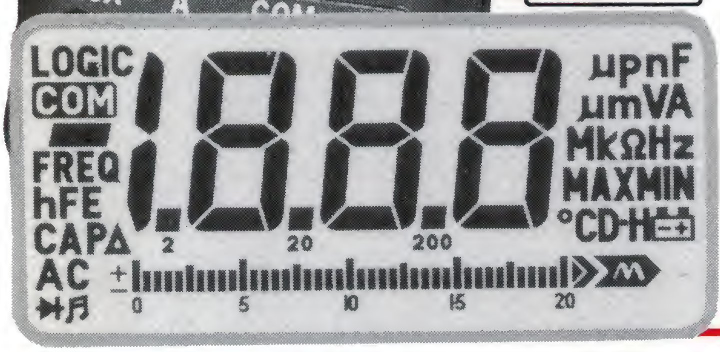
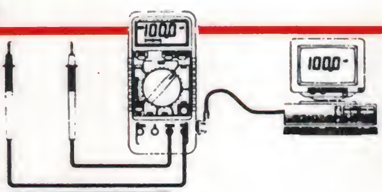
METEX® now can talk to your computer



Reliabilty and Reputation over 7 years in Australia

General Characteristics

Maximum Display	: 19999 counts (4 1/2 digits) -M4650(CR), 1999 counts (3 1/2 digits) -M3650CR with automatic polarity indication
Maximum Input Current of AC/DC	: 20A (maximum of 15 minutes)
Overange Indication	"OL" and "Bar Graph Flashing" on the display
Maximum Common Mode Voltage	: 500V dc/ac rms
Reading Rate Time	: 1-2 readings/2-3 readings (M4650CR) per sec (approximate)
Temperature Range	: Operating 0°C to 40°C, 32°F to 104°F storage -10°C to 50°C, 14°F to 122°F
Power Supply	: One 9-volt battery (NEDA 1604, 6F22 type or equivalent)
Size	: 87W x 187D x 34H m/m
Weight	: 350g ±10g (including 9V battery)
Accessories	: Operating manual, 9V Battery (Zinc-carbon type). A pair of test leads, RS 232C Cable, Floppy Disk (option), Carrying hard case



◄ Interfacing the meter with a PC

◄ M3650CR

M4650 ►

Features (of 36 CR and 46CR)

- The models **36 CR** and **46CR**, portable DMMS, are capable of communicating with computers by means of the **RS 232C**
- The built-in relative offset function enables simple measurement of relative values
- The models enables measurement of logic with **2 test probes** only, comparing with existing modeks with 3 logic probes
- The models enable 3 level display of **HI, MID** and **LOW** on the LCD, comparing with existing models with HI and LOW only. Our models also enable measurement to be made without **the selective switch** of C-MOS TTL
- The **Auto power off** function saves the power consumption
- When the range capacity has been exceeded, our models sound alarm signals while the signal **"OL"** is displayed on the LCD.
- Signals are **sounded** when making selection on the selector
- A wide range of function like **Max, Min** and **Data Hold** make our DMMS convenient to measure with

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READER INFO NO. 29

FLUKE AND PHILIPS – THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

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- *EMI protected and measures up to 600 volts rms.*
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Now there's only one to reach for

Double Duty

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